



THE SPRUCE

BY H. B. HALL

THE
PINETUM
BRITANNICUM

A DESCRIPTIVE ACCOUNT
OF
HARDY CONIFEROUS TREES

CULTIVATED IN GREAT BRITAIN

VOL. I.

W. BLACKWOOD & SONS, EDINBURGH AND LONDON

AND

EDWARD RAVENSCROFT, 14 LOUDOUN ROAD, S. JOHN'S WOOD

MDCCCLXXXIV

TO THE

Illustrious Memory

OF

H.R.H. THE PRINCE CONSORT

This Work

IS

BY HER MAJESTY'S COMMAND

Most reverently Dedicated

By her humble and obedient Servant

EDWARD RAVENSCROFT

P R E F A C E

A SMALL quarto volume of 104 pages, intitled "The Abietinæ," prepared in 1850 for the firm of PETER LAWSON & SON, of Edinburgh, formed the nucleus of the present volumes. Its publication was the result of an attempt to elevate the ordinary trade price-list of a nurseryman into a work of reference; and the example thus set has since been followed by nurserymen in this country, on the Continent, and in America. The preparation of it was attended with a considerable amount of labour, research, and correspondence; and the result was an accumulation of material, only a small portion of which was available for "The Abietinæ." It was with the view of utilising the store of information I had thus acquired that the idea of bringing out a larger work on the Coniferæ arose, and the plan of the "Pinetum Britannicum" was in consequence elaborated.

As its production involved considerable outlay, it was deemed prudent to secure a sufficient amount of support before incurring the risk and responsibilities attendant on the preparation of so costly a series of volumes; and an arrangement was entered into with Messrs. PETER LAWSON & SON, in virtue of which they were to take one hundred copies, and in consideration therefor the work was to bear the title of "Lawson's Pinetum Britannicum," a title which is engraved on all the plates issued while that firm was in existence. A generous support was also accorded by the late EMPEROR NAPOLEON III., who caused thirty copies to be distributed among the Schools of Forestry and Agriculture in various parts of the French Empire. Proof sheets of several of the species were then submitted to the inspection of the QUEEN, through the late Dowager Duchess of SUTHERLAND; and by Her Majesty's command the work was dedicated to the Illustrious Memory of the PRINCE CONSORT, that great and good and wise Prince, for whom the nation was then in the first year of its mourning.

Nearly one hundred private Subscribers were afterwards obtained, and with this assured support the "Pinetum Britannicum" was commenced. The fall of the Second Empire, the transfer of the business of PETER LAWSON & SON to a Limited Liability Company, and the consequent cessation of their subscriptions, rendered it impossible to continue the publication except at a great loss, and it was for some time suspended. Last year, however, with the view of keeping faith with the private Subscribers, it was determined to finish the work, in the hope that in its complete form a sufficient number of copies may be sold to repay the cost of production.

Although a purely personal matter, it is considered that this explanation is due to those Subscribers who have continued their support, notwithstanding the long interruption of the work.

When the "Pinetum Britannicum" was projected, Mr. ROBERT BROWN, then Keeper of the Botanical Department of the British Museum, was consulted, as he had rendered great service to me while preparing "The Abietinæ," and specially in the systematic arrangement of the genera and species. By advice of Mr. BROWN, negotiations were entered into with the late Dr. LINDLEY for the preparation of the botanical descriptions; but after a short time his health failed, and it became necessary to obtain additional aid, when I was so fortunate as to secure the valuable services of Mr. ANDREW MURRAY, Assistant Secretary to the Royal Horticultural Society. Mr. MURRAY was at that time engaged on a monograph of the genus *Cedrus*; and the descriptions in Vol. III. of the three recognised species, *Libani*, *Deodara*, and *Atlantica* (although the two last are considered by him to be varieties only of *C. Libani*) are adapted in part from this monograph, which, however, remained unfinished at the time of his death.

Dr. LINDLEY'S connexion with the work ceased on the appearance of Part 3, and from Part 4 to Part 36, the scientific, botanical, and structural descriptions were contributed by Mr. MURRAY. On the resumption of the publication last year, Dr. MAXWELL T. MASTERS, the successor of Dr. LINDLEY in the editorship of the *Gardeners' Chronicle*, undertook to revise the scientific botanical portions of the remaining Parts. He also supplied the description of *Cupressus macrocarpa*.

It remains to place on record the valuable assistance received during the progress of the work from the late Mr. LAWSON, the venerable head of the firm of PETER LAWSON & SON, and from Mr. PETER S. ROBERTSON and Mr. WILLIAM GORRIE, both now deceased, managers in succession of the Lawson Nurseries, at Edinburgh. The late Mr. JAMES M'NAB, of the Royal Botanic Gardens, Edinburgh, also communicated valuable practical information on the culture and treatment of the more recently introduced species of Coniferæ.

Dr.

Dr. REGEL of St. Petersburg, and the late Professors PARLATORE of Florence and KARL KOCH of Berlin, rendered valuable assistance; while M. HENRI VILMORIN, of Paris, has contributed much interesting information on the growth and cultivation of Coniferæ in France and other parts of Europe.

Thanks are also due to Dr. HUGH CLEGHORN, Mr. GEORGE PATTON of the Cairnies (afterwards Lord PATTON); Sir JOHN NASMYTH, Mr. MAXTONE GRAHAM, of Cultoquoy; Mr. BERESFORD HOPE, Mr. SPIERS, of Culcreuch; Mr. A. F. BARRON, of the Royal Horticultural Gardens at Chiswick; Mr. FROST, of the Gardens at Dropmore; the late Mr. ANDREW TOWARD, of the Gardens at Osborne House; Mr. BARNES, of the Gardens at Bicton, also deceased; Mr. BEGBIE, of Castle Martyr; Mr. ARCHIBALD FOWLER, of Castle Kennedy; and the late Mr. CHARLES MCINTOSH, Dalkeith Palace Gardens.

From the above roll of names it is with a feeling of sadness that it has to be recorded that death has removed no fewer than thirteen since the publication was commenced.

To Mr. CHARLES PALMER, of Manchester, an enthusiast in Coniferæ, the work is largely indebted for the use of his very elaborate Tables on the effects of the severe winter of 1860-61 on the various species.

The coloured portraits of the Trees are, except when otherwise stated, from the original drawings by Mr. WILLIAM RICHARDSON. The portrait of *Pinus insignis*, which forms the Frontispiece of Vol. I., and of *Cupressus Lambertiana* (*macrocarpa*) in Vol. II., are from photographs of trees at Osborne House, which I had the honour to receive by command of the QUEEN. Lady STUART DE ROTHESAY contributed the two very characteristic portrait sketches of old Deodar Cedars in Vol. III., made by her daughter, Lady CANNING, during her sojourn in India. The drawings of the cones and leaves are by Dr. GREVILLE, of Edinburgh, and JAMES and ROBERT BLACK, from specimens at Kew, the British Museum, the Royal Botanic Gardens at Edinburgh, a collection of cones from Messrs VILMORIN, of Paris, and another collection in the Highland Society's Museum at Edinburgh, since removed to the Natural History Museum there. The wood engravings of the structural and microscopical details are from drawings furnished by Mr. ANDREW MURRAY, Mr. JAMES M'NAB, and Dr. GREVILLE, and the plans of the microscopical sections of the leaves in the latter Parts of the work are by Dr. MAXWELL T. MASTERS.

It remains only to add that, while bringing the First Series of the "Pinetum Britannicum" to a close, the original conception of the work is a long way from being fulfilled; but as I am approaching the allotted span of threescore years and ten, it is incumbent on me to undertake no fresh work. It gives me pleasure, however, to state that a Second Series is in contemplation, under the sole direction of Dr. MAXWELL T. MASTERS, of which particulars will be issued when the details are fully matured.

EDWARD RAVENSCROFT.

TABLE OF CONTENTS

VOLUME I.

PINUS ALBICAULIS, <i>Engelmann</i>	PAGE 1	PINUS LAMBERTIANA, <i>Douglas</i>	PAGE 47
" ARISTATA, <i>Engelmann</i>	5	" LARICIO, <i>Poiret</i>	55
" AYACAHUITE, <i>Ehrenberg</i>	9	" MANDSCHURICA, <i>Regei</i>	61
" BALFOURIANA, <i>Jeffrey</i>	11	" MONOPHYLLA (FREMONTIANA), <i>Torrey</i>	65
" BUNGEANA, <i>Zuccarini</i>	13	" MONTICOLA, <i>Douglas</i>	69
" CEMBRA, <i>Linnaeus</i>	17	" PINASTER, <i>Aiton</i>	71
" COULTERI, <i>Don</i>	23	" PORPHYROCARPA, <i>Hort</i>	83
" EXCELSA, <i>Wallich</i>	27	" SABINIANA, <i>Douglas</i>	85
" FLEXILIS, <i>Torrey</i>	33	" TÆDA, <i>Linnaeus</i>	89
" INSIGNIS, <i>Douglas</i>	37	" TUBERCULATA, <i>Don</i>	93
" JEFFREYII, <i>Balfour</i>	45	ARAUCARIA IMBRICATA, <i>Jussieu</i>	99

COLOURED PLATES.

Pl. 1, PINUS INSIGNIS, <i>Douglas</i> , Tree at Osborne House, FRONTISPIECE		Pl. 8, PINUS LARICIO, <i>Poiret</i> , Cone and Leaves	PAGE 55
" 2, " AYACAHUITE, <i>Ehrenberg</i> , Cone and Leaves	PAGE 9	" 9, " MONOPHYLLA, <i>Torrey</i> , Cone and Leaves	65
" 3, " CEMBRA, <i>Linnaeus</i> , Cone and Leaves	17	" 10, " PINASTER, <i>Aiton</i> , Cone and Leaves	71
" 4, " EXCELSA, <i>Wallich</i> , Cone and Leaves	27	" 11, " SABINIANA, <i>Douglas</i> , Cone and Leaves	85
" 9, " FREMONTIANA, <i>Endlicher</i> , Cone and Leaves	65	" 12, " TÆDA, <i>Linnaeus</i> , Cone and Leaves	89
" 5, " INSIGNIS, <i>Douglas</i> , Tree at Mendicino, California	37	" 13, " TUBERCULATA, <i>Don</i> , Cone and Leaves	93
" 6, " JEFFREYII, <i>Balfour</i> , Cone and Leaves	45	" 14, ARAUCARIA IMBRICATA, <i>Jussieu</i> , Tree at Dropmore	99
" 7, " LAMBERTIANA, <i>Douglas</i> , Cone and Leaves	47	" 15, " " " " Cone and Leaves	100

VOLUME II.

ABIES ALBERTIANA, <i>Murray</i>	PAGE 111	PICEA CEPHALONICA, <i>Loudon</i>	PAGE 175
" DOUGLASII, <i>Lindley</i>	115	" NOBILIS, <i>Loudon</i>	181
" EXCELSA, <i>De Candolle</i>	135	" PINSAPO, <i>Loudon</i>	189
" HOOKERIANA, <i>Murray</i>	153	CUPRESSUS LAWSONIANA, <i>Murray</i>	191
" PATTONIANA, <i>Jeffrey</i>	157	" MACROCARPA (LAMBERTIANA), <i>Hartweg</i>	195
" MEDIOXIMA, <i>Nylander</i>	159	" NUTKAENSIS, <i>Hooker</i>	199
" ORIENTALIS, <i>Poiret</i>	163	" TORULOSA, <i>Don</i>	201
PICEA APOLLINIS, <i>Rauch</i>	167	TAXODIUM DISTICHUM, <i>Richard</i>	205
" BRACTEATA, <i>Loudon</i>	171	" MONTEZUMÆ, <i>Dunal</i>	215

COLOURED PLATES.

Pl. 16, ABIES ALBERTIANA, <i>Murray</i> , Tree at the Cairnies, FRONTISPIECE		Pl. 26, PICEA BRACTEATA, <i>Loudon</i> , Cone and Leaves	PAGE 172
" 17, " DOUGLASII, <i>Lindley</i> , Tree at Bicton	PAGE 115	" 27, " CEPHALONICA, <i>Loudon</i> , Cone and Leaves	175
" 18, " " " " Cone and Leaves	116	" 28, " NOBILIS, <i>Loudon</i> , Tree at Dropmore	181
" 19, " EXCELSA, <i>De Candolle</i> , Cone and Leaves	135	" 29, " " " " Cone and Leaves	182
" 20, " CARPATICA, Cone and Leaves	137	" 30, " PINSAPO, <i>Loudon</i> , Cone and Leaves	189
" 21, " HOOKERIANA, <i>Murray</i> , Tree (a Portrait) on Scots Mountain—background a fancy sketch	153	" 31, CUPRESSUS LAWSONIANA, <i>Murray</i> , Branch in Flower	191
" 22, " HOOKERIANA, <i>Murray</i> , Cone and Leaves	156	" 32, " MACROCARPA, <i>Hartweg</i> , Branch in Fruit	195
" " PATTONIANA, <i>Jeffrey</i> , Cone and Leaves	156	" 33, " LAMBERTIANA (MACROCARPA), <i>Douglas</i> , Tree at Osborne	196
" 23, " ORIENTALIS, <i>Poiret</i> , Cone and Leaves	161	" 34, " NUTKAENSIS, <i>Hooker</i> , Branch in Fruit	199
" 24, PICEA APOLLINIS, <i>Rauch</i> , Cone and Leaves	167	" 35, " TORULOSA, <i>Don</i> , Branch in Fruit	201
" 25, " BRACTEATA, <i>Loudon</i> , Tree at Santa Lucia	171	" 36, TAXODIUM MONTEZUMÆ, <i>Dunal</i> , Tree at Mexico	215

VOLUME III.

CEDRUS ATLANTICA, <i>Manetti</i>	PAGE 217	SEEDS OF CONIFEROUS TREES	PAGE 323
" DEODARA, <i>Loudon</i>	225	PRICES OF CONIFEROUS TREES	325
" LIBANI, <i>Barrelier</i>	247	INDEX OF GENERA, SPECIES, AND SYNONYMS	327
SEQUOIA WELLINGTONIA, <i>Seeman</i>	299	INDEX OF PERSONS AND PLACES	329

COLOURED PLATES.

Pl. 37, SEQUOIA WELLINGTONIA, <i>Seeman</i> , Trunk of Tree at Mariposa Grove	FRONTISPIECE	Pl. 45, CEDRUS LIBANI, Cone and Leaves	PAGE 248
" 38, CEDRUS ATLANTICA, <i>Manetti</i> , Cone and Leaves	PAGE 218	" 46, " Map shewing Distribution of the Cedars	251
" 39, " DEODARA, <i>Loudon</i> , Tree at Bicton	225	" 47, " Cedars on Mount Lebanon (Photograph)	260
" 40, " " " " Cone and Leaves	230	" 48, " One of the largest Cedars	264
" 41, " A Grove of Deodars at Nachar	244	" 49, " Group of Cedars	268
" 42, " Unripe Cones of C. Deodar and C. Libani	245	" 50, " Cedar near the Chapel	274
" 43, " Twin Deodar at Nachar	246	" 51, SEQUOIA WELLINGTONIA, <i>Seeman</i> , Cone and Leaves	299
" 44, " LIBANI, <i>Barrelier</i> , Tree at Syon House	247	" 52, " SEMPERVIRENS, Cone and Leaves	303
		" 53, " WELLINGTONIA, <i>Seeman</i> , Two Guardsmen	305

PINUS ALBICAULIS

(*Pinus flexilis* of English Arboriculturists).

IDENTIFICATION.—PINUS ALBICAULIS, Engelmann in *Trans. Acad. Sc. of St. Louis*, ii. p. 209 (1863).

PINUS FLEXILIS, Committee of Oregon Botan. Assoc. (Balfour), in *Circular to Subscribers* (1852).

PINUS CEMBROIDES, Newberry in *U.S. Pacif. Rail. Expedition*, vol. iv., *Bot. Rep.*, p. 44 (1857) not of Zucc.

PINUS FLEXILIS, var. ALBICAULIS, Engelmann in *Botany of California*, ii. 124 (1880).

PINUS SHASTA, Carriere, *Traité*, ed. 2, p. 390.

Specific Characters.—Pino Cembræ affinis, foliis quinis, interdum binis ternis vel quaternis, $1\frac{1}{2}$ vel 2 pollices longitudine; strobilis erectis late ovatis rubro-fuscis, squamis latissimis orbiculato-rhombeis apophysi tumido pyramidato, umbone sub-acuto; seminibus apteris. Habitat in montibus in Oregon et California.

Description.—A tree with a spreading top, varying in size according to situation, reaching 50 feet high, with a trunk 1 foot in diameter, down to a shrub 3 feet high. High up on the mountains it diminishes until it almost creeps along the ground, with a tabular top so compact that a person can walk on it. The bark of the trunk is as white as milk, but moderately rough and thin, having (according to Dr. Newberry) much the appearance of the bark of the White Oak (*Quercus alba*) in trees of moderate size. The bark of the branches is loose, spongy, grey, smooth, and tender; the wood of the branches very flexible and tough. The leaves (fig. 1) are densely crowded together, confined to the extremities of the branches, five in a sheath, but sometimes fewer (two, three, or four), pale bluish-green, triangular and smooth, those of each fascicle of uniform length and approximated, giving the foliage a notched or cropped look; they are subserrated, the serrations being at long distances from each other. Beneath the epiderm is a thick layer of hypoderm, which is extended round each of the three sub-epidermal resin-canals (fig. 2),



Fig. 1.

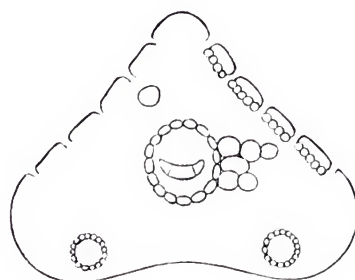


Fig. 2.



Fig. 3.



Fig. 4.

though Engelmann says that the ducts of *P. flexilis* are destitute of strengthening cells. Male catkins, in a specimen collected by Sir J. D. Hooker and Dr. Gray on Mount Shasta, about half-an-inch long, oblong, surrounded at the base by overlapping ovate-acute boat-shaped scales; filaments slender, anther purplish, connective, straight, or reflexed, crested or reduced to a sharp point. Cones (fig. 3) erect or divergent,

PINUS ALBICAULIS

divergent, 2 to 3 inches long, ovoid in outline, oblique at the base, of a reddish-brown colour, very smooth and free from resin. They are composed of scales which are thick and woody, and of the same felt-like texture as the cones of the Cembra and most Silver Firs; the apophyses project in flattened cones of considerable length, sometimes terminating in knobs; the umbo is small, terminating in a point, but has no spine. The seeds (fig. 4) are wingless, or nearly so; when mature they are oval in form, the size of large peas, and their flavour is agreeable.

Dr. Newberry mentions that the cones were so rare, that although constantly among the trees, and on the outlook himself, he for long failed to find a single good cone, and he had for two weeks an offer open to all his party of a dollar for one, without any one being able to claim the reward. Fragments of cones recent or of other years were under every tree, but they had been most carefully sought and torn up by the little pine squirrels for the sake of the kernel. At the end of two weeks' search, a smile of fortune led him where his wants were fully supplied. It is curious enough that similar difficulty was experienced by Dr. Lyall when exploring the Cascades on the North American Boundary Commission; and we happen to know that of the cones of this species sent home by Jeffrey, scarcely a good well-formed cone was to be found: they were almost all injured or bent to one side.

Geographical Distribution.—It was met with on Mount Shasta in North California, lat. $41^{\circ} 35'$, growing on granite rocks, at an elevation of 8000 to 9000 feet, and in the same locality more lately by Sir Joseph Hooker and Dr. Asa Gray. It was also found by Dr. Newberry in the passes of the Cascade Mountains, about lat. 44° north. He says that his party crossed the mountains several times at an altitude of about 7000 feet (the line of perpetual snow). After reaching an altitude of 5500 feet, among the Firs and Spruces, which cover the mountains' sides, Pines of a species then quite new to him began to appear. As they ascended they left behind them *Abies Menziesii* and *A. Douglasii*, *Picea grandis* and *P. amabilis*, which grew luxuriantly below; and at the height of 6500 feet found the scattered clusters of trees to be composed of nearly equal numbers of this species of Pine and of the beautiful Spruce *A. Hookeriana*, which, in ignorance that it had been previously described, Dr. Newberry named *A. Williamsoni*. Still higher, at the extreme limit of vegetation, the bleak and barren surfaces were held by this Pine in possession undisputed by other trees, but opposed by the rigours of a climate which had bowed it to the ground, forcing it to grow in thick and tangled masses scarcely rising above the surface; the trunks, sometimes of considerable size, creeping about among the rocks like roots.

It is, we imagine, to this species that Dr. Lyall refers when he speaks of *P. flexilis* being found by the North American Boundary Commission on the Cascade Mountains. He says: "*P. flexilis* was first observed by us near the eastern summit of the Cascade Mountains, about 7000 feet above the sea, when it was found as the highest tree of the forest belt growing amongst rocks and granite debris, exposed to the full force of the storms which so frequently sweep over this elevated region. Here it was quite stunted and shrubby in its habit. The trunk of the largest seen in this situation was about 15 feet high, bulging out a little for a foot or so above the ground, and tapering pretty rapidly, and spreading out at the top into a number of thickish branches.

"No cones of this tree could be found on the Cascades. In the following year, however, they were procured both on the Galton and Rocky Mountains in great plenty, but unfortunately all too young for the seed to be of any use. The seed, which is about the size of a pea, is sweet and palatable, and is eaten by the Indians. This tree was found growing on the Rocky Mountains at an elevation of 8000 feet" (Lyall in "Journ. Linn. Soc.," vii. p. 142, 1864).

Dr. Engelmann quotes Dr. Lyall's habitat as belonging to the true *P. flexilis*; but its being found on the Cascade as well as on the more northern part of the Rocky Mountains, together with its small size, creeping habit, and small size of the seeds (the only points noticed), would in themselves lead us to think that it more properly belongs to the Cascade Mountains form of *flexilis*,—that is, *P. albicaulis*—but we have

PINUS ALBICAULIS

3

have had, moreover, the opportunity of examining Dr. Lyall's specimens themselves in Kew Herbarium, and find them identical with those of the present species sent home by Jeffrey.

Dr. Lyall refers them to the *P. flexilis* of Torrey, and notes specimens of another species of which he procured the leaves, but not the cones, as probably the *P. Cembroides* of Newberry, but this seems to be an error. The latter is doubtless *P. aristata*, with which its foliage in all respects corresponds.

Dr. Engelmann, in the "Botany of California," says that this is only an alpine form of *flexilis*, occupying a higher belt on the mountains, and marked by its short, thick, and thick-scaled cones.

History.—This species was first found by Jeffrey, the Collector of the Edinburgh Oregon Botanical Association. He sent seeds and specimens home in 1851. They were unknown to the Committee, and after a consultation between the best authorities in Edinburgh and London, they arrived at the conclusion that they belonged to *P. flexilis* of James and Nuttall. This, however, seems to have been an error, for, although nearly allied, the two species appear to be distinct, the *flexilis* of James having the cones pendent or semi-pendent, and 4 or 5 inches long, while in this species they are erect, and only 2 inches long. This species also differs in having the branches pubescent, a few scattered teeth on the edges of the leaves, and by having short oval cones with thick squamose scales sometimes pointed with a knob, and lastly by the colour of the bark of the tree, which Dr. Newberry describes as white as milk, from which character Dr. Engelmann originally proposed for it the name of *albicaulis*.

Dr. Newberry, who next after Jeffrey met with the present species, found that his description agreed well with that of his tree, except that he did not mention the white bark. He came to the conclusion, however, that it was not the *P. flexilis* of James, and he recorded it under the name of *P. Cembroides*, supposing it to be the tree so named by Zuccarini—a supposition, however, solely based on conjecture from the name itself, for he mentions that he had not seen Zuccarini's description. His reference is "*Cembroides*, Zucc. Journ. Hort. Soc." i. 236. That reference belongs to Gordon, not to Zuccarini. The description by the latter is given to the "*Flora*," 1832. And if it is Gordon's *Cembroides* that Newberry really refers to, there is not the slightest question that it is different from this species. This is of the *Cembra* type, with felt-like surface. Gordon's (see woodcut in *P. Cembroides*) is with a hard, somewhat glossy apophysis, and has no relation to *Cembra*, and it is apparent that the same is the case with Zuccarini's, the cone of which is described by him as with "strobilis sub-globosis, squamis (seminiferis) basi concavis coriaceis apicem versus induratis recurvis rhombeo vel pentagono umbonatis"—that is, with sub-globose cones, and with the scales (seed-bearing) hollow at the base, with the apophysis coriaceous, hardened, recurved, and with a rhomboidal or pentagonal umbo—a description perfectly applicable to the *P. edulis*, but not to any member of the *Cembra* section. Zuccarini applied the name "*Cembroides*" (*Cembra*-like) to it—not on account of general similarity, but on account of resemblance in a single point—viz., "Das gefuge der Zapfenschuppen ist ganz dem von *P. Cembra* ahnlich und veranlasste mich desshalb zu dem trivialnamen *P. Cembroides*" (Zuccar. in "*Flora*," 1832, ii. 93). "The groove of the scales of the cone is wholly similar to that of *P. Cembra*, and suggested to me on that account the trivial name *P. Cembroides*." He had already in the description specially mentioned the groove or concavity of those of the scales which were seed-bearing—a deep hollow in which, in *P. Cembra* and all the Nut Pines, the seed is ensconced. Zuccarini, having never seen that peculiarity in any but *P. Cembra*, naturally thought it a remarkable character, but it is not a character confined to *Cembra*. It occurs in all the sections of Pines where the seeds are large.

Dr. Engelmann having afterwards received specimens of the true *P. flexilis*, gave (*loc. cit.*) a more accurate description than had previously been done of that species, and pointed out the differences between it and the present species; and as the name *Cembroides* given to the latter by Dr. Newberry could not stand, he gave it the name (*albicaulis*) which we have adopted. In his more recent monographs, however, Engelmann refers the plant as a variety to *P. flexilis*.

Properties

PINUS ALBICAULIS

Properties and Uses.—The timber of this species is said by Dr. Newberry to be white and soft, and not highly charged with resin, and to resemble that of *P. Strobus* and *P. Lambertiana*.

The seeds are edible, but smaller than those of other Nut Pines.

Culture.—There are few specimens in Britain. As might be expected, none of them were touched by the severe winter of 1860–61.

PINUS ARISTATA.

IDENTIFICATION—PINUS ARISTATA, Engelmann in *Trans. of Ac. of Sc. of St. Louis*, vol. ii. p. 205, 1863, *Gard. Chron.*, Oct. 30, 1875, p. 549.

PINUS BALFOURIANA, var. ARISTATA, Engelmann in *Bot. California*, ii. p. 125.

ENGRAVINGS.—*Cones and Leaves*.—Engelmann, *loc. cit.*, tab. 5 and 6.

Specific Characters.—Pinus modica altitudine; foliis dense congestis quinque abbreviatis, viz. uncialibus, integris rigidis acutiusculis curvatis ex axillis perularum per plures annos persistentium; amentis masculis ovatis involucri 4 phyllo munitis in axilla bracteae ovatae acuminatae persistentis stipitatis; antherarum, crista ad umbonem parvulum singulum vel binos reducta; amentis femineis erectis herbaceo-echinatis atro purpureis; strobilis ovatis ($2\frac{1}{2}$ – $4\frac{1}{2}$ ") horizontalibus violaceo-fuscis, squamarum elongato-cuneatarum apophysi rhombea parum tumescente transverse acute carinata parte superiori augustiori medio in umbone aristata; seminibus breviter alatis ala ipsa oblique obovata duplo minoribus concoloribus.

Habitat montibus rupestribus super culmina altiora et nivosa circa "Pike's Peak," Colorado.

A tree reaching in sheltered situations 40 or 50 feet high and 1 or 2 feet in diameter; but on more exposed and lofty places only a stunted bush. The bark is thin and scaly, even in older trees not more than three or four lines thick, of a light greyish-brown colour; that of younger branches smooth, with many large vesicles containing a clear fluid balsam, which remains between the layers of the old bark. Branches spreading, very often many of them twisted, stunted, or dead; the larger branches and the stem itself frequently covered with young branches or shoots, which seem to keep life in the old trunk. The branchlets are thickly set and closely covered with fascicles of leaves, the sheaths, which are very short and broad (varying from one-half to one line in length), with somewhat loose and ragged light-brown oval acuminate scales, standing like short cups, with the edges turned over: these remaining longer than the leaves themselves, cover the branches with their rough, blackish remains. The leaves, five in each sheath, are light green on both sides, the stomata not very perceptibly distinguished by white efflorescence, mostly with numerous exudations of white resin, usually curved upwards, entire on the edges and keel, abruptly acutish, stouter in fruit-bearing branches, more slender in such trees as produce principally male flowers, in very robust specimens $1\frac{1}{4}$ and rarely even $1\frac{1}{2}$, usually about 1 inch long; on sterile branches straight and horizontal, "giving the branches the appearance of so many little brushes," with from one to three longitudinal grooves, but no rows of stomata, along the back of the leaf, usually three grooves at the base, the two outer of which soon disappear, and with some very irregular rows of stomata on the other two sides of the leaf, usually from three to five, the rows being very fine cut and narrow, the line being occasionally interrupted, and when a greater number of rows than three are present it seems to be by two very close together being substituted for a space for a single line (fig. 1). The sheaths consist of seven to eight oblong scales with fringed margins, adpressed and forming a sheath 3 to 4 lines long on the young leaf, soon spreading and squarrose, falling off in the second or third year. The resin ducts are described by Engelmann as peripheral and surrounded by strengthening cells; but in specimens exhibited by us there was only a single canal.

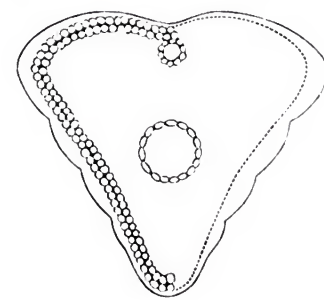


Fig. 1.

Many lanceolate acuminate scales, perulae, sheathe the lower part of the young shoots; shorter and broader bracts, bearing in their axils the male catkins, follow next. The aments together form a very short

PINUS ARISTATA

branched spike or rather head, 6 or 8 lines long; often these heads persist on the axis for two or even three years, with a few bunches of leaves above each one, giving the appearance of a leafy spike 1 or 1½ inches long.

Professor Engelmann says—"I have seen branches with sixteen naked spaces, proving that leaves were persistent for sixteen years, a fact unheard of among Pines where leaves are said to endure generally only three years. The stipitate oval ament, 3 to 4 in. long, has a proper involucre of four oblong scales or bracts of equal length."

Male catkins short, clustered round the branchlet chiefly towards the apex; the crest of the anther unusually small, scarcely indicated by a knob. Female catkins single or two together, near the end of the young shoot, bristling with the lanceolate, aristate, erect scales, of purple-black colour. Cones oval, obtuse, 2¼ to 2½ inches long, about half as much in diameter, often covered with resin as if varnished; growing erect or nearly so, two or three near each other, at the termination of the small branches of the branchlets, cylindrical obovate when fresh, wider and more expanded in appearance when dry and open, with eight rows of scales on the long spiral. Scales dark purplish-brown where exposed (viz., on the apophysis), pale fawn-colour where not exposed, the apophysis with a central rhomboidally shaped umbo, from which springs a transverse, somewhat pyramidal mucro, terminating in a long, soft flexible spine about 3 lines in length, hollow at the base of the under side, rounded on the upper, with a sharp transverse keel stretching across the apophysis, dividing it into two unequal divisions, the upper of which is the shortest, and with the edges more or less rounded and longitudinally wrinkled. Bracts much altered and apparently obsolete, actually connate with the base of the scale, mucronate part free and membranaceous; seeds small, pale fawn-coloured, about 1½ lines in length, placed obliquely to the wing, which is pale, translucent, and short, about 3 or 4 lines in length, and 2 or 2½ lines in breadth. Embryo with seven short cotyledons.

Description.—This is a very remarkable species, combining much of the appearance of the foliage of a Fir with the characters of a Pine, its leaves being no larger than those of a Fir. It belongs to Endlicher's section of Pines named *Pseudostrobus*; but the extreme shortness of its leaves, and the cone constructed on quite a different principle—for example, with a central instead of a terminal umbo—would warrant a new section being established for the reception of it and of one other species with equally short leaves—viz., *Pinus Balfouriana*. Yet it is essentially an alpine species, and on the higher bleak mountains is a stunted bush often thickly covered with fruit. Dr. Engelmann, in a supplement to the "Enumeration of Plants," in Dr. Parry's collection in the Rocky Mountains, says—"Its growth, at least in the latter localities (exposed lofty situations), is exceedingly slow, as a stick of scarcely more than 1 inch in diameter brought back by Dr. Parry shews nearly fifty annual rings, some of them ⅙ of a line, and none more than ⅙ of a line wide. In sheltered situations it is a tree 40 or 50 feet high, and 1 or 2 feet in diameter. Prostrate and almost creeping on the bleak summits of the high ridges. It flowers in the end of June and beginning of July" (*American Journal of Science*, 2d. ser., vol. xxxiv., No. 102, Nov. 1862).

Geographical Distribution.—Found in the heart of the Rocky Mountains, on alpine heights, between 9200 and 11,800 or 12,000 feet high, on Pike's Peak and the high mountains of the Snowy Range; also on the heights of the Coochetopa Pass, nearly south-west of Pike's Peak, altitude over 10,000 feet. Flourishes best in the higher elevations, and never descends below 9000 feet, in its lower ranges not ripening its fruit as well as on the bleak heights. Dr. Engelmann speaks of it from this character as being the American representative of the European *P. Pumilio*. It characterises the highest belt of timber on the peaks of Colorado.

History.—This species seems to have been first noticed by Captain Fremont. On his first expedition he collected a species which could not be satisfactorily determined for want of cones. It was noticed, however,

however, in the Botanical Appendix to his Report, 1843, p. 97. The next person who observed it seems to have been Mr. Creutzfeldt, the botanist of one of the United States Pacific Railroad Exploring Expeditions, under Captain Gunnison. The country explored by that expedition was the district stretching from Fort Leavenworth at the junction of Kansas and across the Missouri River, the highest part of the range of the Rocky Mountains near Pike's Peak, and thence to the Utah or Salt Lake and Lake Sevier. While completing their explorations about the latter lake, Captain Gunnison and a small detached party were treacherously and barbarously murdered. They had been for some time in the district of the Utah Indians, and were aware that they were all around them; but long-continued impunity from a constantly threatened danger induces a reckless indifference to it, which often provokes the catastrophe. Captain Gunnison, tempted by abundant grass, fuel, and water, was imprudent enough to encamp in a little nook in a river bottom, with the river in front, sheltered by the high second bank of the river on one side, and thick willows, distant scarcely thirty yards, on two of the others, under cover of which an enemy might unseen steal close upon them. This tempting place of comfort and utility was accepted probably without a thought of danger. It was known to the party that a band of Indians was near them, for their fires had been seen daily since they entered the valley; but an unusual feeling of security against them was felt, as Captain Gunnison had learned that a recent quarrel, resulting in several deaths, which they had had with the emigrants had terminated, and that, notwithstanding this difficulty, they had remained at peace with the neighbouring settlers, which had been confirmed and guaranteed for the future in a "talk" held with some of the Indians of this band by an agent of the Governor of the territory. His successor, Lieutenant Beckwith, thus concludes the tale:—"The usual precaution of a camp guard had been taken, each of the party (including the commander) in turn having performed that duty during the night. At the break of day all arose and at once engaged in the usual duties of a camp preparatory to an early start to reach that day the most distant part of exploration for the season. The sun had not yet risen, most of the party being at breakfast, when the surrounding quiet and silence of this vast plain was broken by the discharge of a volley of rifles and a shower of arrows through that devoted camp, mingled with the savage yells of a large band of Pah-Utah Indians almost in the midst of the camp; for under cover of the thick bushes they had approached undiscovered to within twenty-four yards of the camp-fires. The surprise was complete. At the first discharge the call to 'seize your arms' had little effect. All was confusion. Captain Gunnison, stepping from his tent, called to his savage murderers that he was their friend; but this had no effect. They rushed into camp, and only those escaped who succeeded in mounting on horseback, and even then they were pursued for many miles."* Captain Gunnison fell pierced with fifteen arrows. The mutilation of scalping was spared them, that being a barbarity in which some of the tribes west of the Rocky Mountains seldom indulged in; but other mutilations of the dead, such as cutting off their arms at the elbow, took its place.

The murder proved to be the unauthorised work of some of the inferior men of the tribe, who, seeing the opportunity afforded by the too accessible site of the camp, had been tempted to make the attack. Most of the property and instruments and all Captain Gunnison's papers were recovered through the Mormon Governor, Brigham Young. "Kenosh, the chief of the band of murderers, arrived at Filmore, having been sent for by Mr. Call, accompanied by fifteen or twenty of his people. He brought with him one of the public horses lost by Captain Gunnison's escort, 'which,' he said, 'he had taken from the fellow who came to him with the intelligence of their successful operation, and hastened to return it, meeting Mr. Call's messenger (who had been sent for him) on the way; that he deeply regretted the tragedy; that it was done without authority by the young men—boys, as he called them—of the band, who had no chief with them, or it would not have happened.' He subsequently informed the Governor's agent that there

* United States Pacific Railroad Exploration, vol. ii. p. 74.

PINUS ARISTATA

were thirty of his people in the party, two of whom were its instigators, seeking revenge for the death of their father, who, they said, had been killed by emigrants but a few days before."*

This sad termination to Captain Gunnison's command gives a melancholy interest to the discoveries made in its course by him and Mr. Creutzfeldt, who was also one of those murdered on the same occasion, and one of those discoveries certainly was the present species, *P. aristata*, although, as in Captain Fremont's case, the specimens, not being in fruit, were insufficient to allow it to be described. Among the specimens collected by Mr. Creutzfeldt were some of a Fir obtained at the highest places on the Coochetopa. It is thus noticed in the Botanical Report by Torrey and Gray, appended to Lieutenant Beckwith's "Report of Captain Gunnison's Exploration:"—"Pinus (undetermined), apparently between *P. flexilis* of James and *P. Strobilus*. Leaves in fives, about an inch and a half long, besmeared with a clear, colourless balsam. For want of the cones it cannot be satisfactorily determined. Perhaps it belongs to that section of the genus which includes *P. edulis* (Eng.) and *P. monophylla* (Torr.)."

Practically speaking, however, although thus twice discovered, it was still unknown when Dr. Parry at last, in 1861 and 1862, obtained specimens in fruit on Pike's Peak and other high mountains of the Snowy Range. Messrs. Hall and Harbour in 1862 also collected it, and Dr. Parry and Dr. Engelmann made it known to men of science. A few cones and seeds, which must, doubtless, have been collected by some members of the parties in 1861 or 1862, found their way to Britain, and were sold by auction in London, where they brought high prices, more for herbarium specimens than for sowing and growing. We have not heard whether any have germinated in this country.

This species is possessed of peculiar interest from its close affinity to one or two very similar Mexican species found by Roezl on the highest peaks of the Mexican mountains. These are not yet described, but have been known to us for a number of years, and quite correspond in the most remarkable features of *P. aristata*—the shape, texture, and colour of its cone, and its short and dense leaves, &c.—this affinity being unquestionably an evidence that the line of the Rocky Mountains was the route by which this species at the close of the glacial epoch found its way so far away from its nearest allies.

Properties and Uses.—Of course, not much is known on this subject; but we learn from Dr. Parry that the wood is white, tough, not very resinous; of extremely slow growth, so that a small, smooth, barked stem of 13 lines diameter exhibited about 50 annual rings, all between $\frac{1}{8}$ and $\frac{1}{60}$ line wide, the smaller ones consisting of 3.6, the widest ones of 15.25 layers of cells, each cell 0.007 line in diameter. A tree of 2 feet thickness would at that rate indicate an age of over 1000 years; but the annual rings of larger trees growing in less favoured situations are wider, and, if a specimen sent by Dr. Parry be not wrongly labelled, sometimes as wide as $\frac{1}{3}$ line, giving the largest trees a probable age of 500 to 800 years.

Culture.—Nothing is known on this subject beyond what common sense would dictate. A plant from the highest peak of the Rocky Mountains will, of course, be better adapted to the highlands of Scotland than the fields of Kent. The ordinary treatment of alpine plants would seem to be what is best fitted for its young days.

Commercial Statistics.—The price obtained at the public sale of the cones and seeds above referred to was as high as a guinea for one or two empty cones. Young plants can scarcely be said to be in the market.

* United States Pacific Railroad Exploration, vol. ii. p. 76.



Bot. Black Tree

Robt. Black Tree

PINUS AYACAHUITTE, Ehrenberg.

Painted from Zucc. by W & A E Johnson, Edinburgh.

PINUS AYACAHUITE

IDENTIFICATION.—PINUS AYACAHUITE, C. Ehrenberg; Schlechtendal in *Linnaea*, xii. p. 492 (1838); Loudon, *Encycl. of Trees*, p. 1023 (1842); Spach, *Hist. Nat. Veget. Phaner.*, xi. p. 4 (1842); Antoine, *Conif.*, p. 47 (1846); Endlicher, *Syn. Conif.*, p. 149 (1847); Knight, *Syn. Conif.*, p. 34 (1850); Lindley and Gordon, *Journ. Hort. Soc.*, v. p. 215 (1850); Carrière, *Traité Gén. des Conif.*, p. 306 (1855); Gordon, *Pinetum*, p. 216 (1858); and ed. 2, p. 292; Henkel and Hochstetter, *Synop. d. Nadellh.*, p. 96 (1865); Parlatore in *D. C. Prod.*, xvi. 2, p. 406 (1868); Engelm., *Revision of Genus Pinus*, p. 15 (1880); Veitch, *Manual of Coniferae*, p. 176 (1881); Masters in *Gard. Chron.* (October 14, 1882).

PINUS STROBILIFORMIS, Wislizenus.

ENGRAVINGS.—*Leaves, &c.*—Loudon, *Encycl. of Trees*, f. 1919–1921. *Cones, &c.*—Masters, *Gard. Chron.* (October 14, 1882).

Specific Character.—*P. foliis quinis filiformibus; strobilis cylindrato-conico-acutis prælongis, squamarum apophysi dimidiato pyramidata acuminata, in strobilis maturioribus versus basin apice plus minusve recurva umbone terminali obtuso.*

Habitat in Mexico, montibus provinciarum, Chiapa et Oaxaca.

A tree reaching 100 feet in height: in youth not unlike *Pinus excelsa*. Branchlets devoid of leaves at the base, and clothed with a ferruginous pubescence, which soon disappears. Bark of the trunk of a dull green or leaden greyish hue, smooth in the young trees, and when older rough with the pulvinuli of the fallen leaves. Buds short, peaked at the apex and swollen behind, clothed with short linear triangular scales, which are afterwards reflexed and fall off. Leaves in fives (see fig. on plate), triquetral, 3 or 4 inches long, turned back, narrow, weak, and lank, scarcely exceeding the third part of a line in breadth; point acute and tapering, with no lines of stomata on the back; with from three to six rows on each side of the inner face; the margins both of the sides and keel very minutely serrulate. The resin canals are peripheral and surrounded by hypoderm cells (in a specimen grown at Cheshunt), though Engelm. says there are no such fibres around the ducts. Sheath of the leaves composed of scales nearly an inch long, soon falling off. Male flowers not observed. Cones pendent (see plate), very long (9 to 12 inches), usually curved, narrow, cylindrical in the middle, but attenuated at both ends, apex pointed. Scales, when mature, fully 2 inches in length (see plate), often grooved longitudinally, almost of a corky substance, apophysis greyish-white, forming a strong contrast with the part of the scale not exposed to the light, which is dark umber-brown, with a pyramidal apex and a small brownish umbo. The apex in the older cones is sometimes reflexed, more especially in the sterile scales towards the base. The plate shews the scale of a mature cone. Seeds winged (see plate), small for the size of the cone (about 2 lines long), obovate, testaceous, brown, often marked longitudinally with darker lines. The wing (see plate) is about an inch long, and about 5 lines at its broadest part, obliquely truncate, of the same colour as the seed, with darker longitudinal stripes or lines. Cotyledons twelve.

Mr. Gordon says (*Pinetum*, Supplement to ed. 1, p. 72), that among the Pines introduced by M. Roezl there were two *Ayacahuites*—one the white and the other the red; that the former, *Pinus Ayacahuite blanco*—which from his reference we presume to be meant by him for this species—is the same as Roezl's *P. Bonapartei*, and that his *P. Ayacahuite colorado* is *P. Loudoniana*, Gordon. Whether these synonyms be correct or not, neither of them appears to us to belong to this species, so far as we can judge from the materials we have seen. Mr. Gordon's opinion is given after the inspection of Roezl's specimens in the hands of Mr. Standish. We also have seen a set of specimens of Roezl's species, purchased in Mexico

from his partner M. Besserer, but we have no assurance that the same names are represented by the same things in both instances, although we have no reason to doubt it. If they are, our opinion is not the same as Mr. Gordon's. We find *P. Bonapartea* distinct from this species, and also from Roetz's *P. Don Pedri*, his *P. Veitchii*, his *P. Durangensis*, and his *P. Popocatepetli*. We may add that Mr. Gordon's own description of *P. Bonapartea* agrees better with *P. Loudoniana* than with *P. Ayacahuite*. For example, he says the seeds of *Bonapartea* are large, which is the case with *Loudoniana*, although not with *Ayacahuite*, in which they are only 2 lines in length.

Geographical Distribution.—The following are the localities where this species has been noticed:—viz., at Omitlan, near the hacienda of Guerrero; on the mountains in the provinces of Chiapas and Oaxaca, especially on the higher parts of the Combre mountains and about Cosiquiriachi and Mount Pelada. Mr. Gordon states that “it is also very common on the mountains of Quezaltenango, at an elevation of 8500 feet, and on the neighbouring mountain of Santa Maria, where it is called ‘Tablas’ by the inhabitants, and ‘Ayacahuite’ by the Mexicans;” but he does not give his authority for the statement. Endlicher gives its range of latitude as from 16° to 18° N.

History.—First observed by C. Ehrenberg near Guerrero in Mexico, and communicated by him to Dr. Schlechtendal, who, in 1838 (being then editor of the *Linnæa*), published a description of it in that journal, along with descriptions of some other Mexican Pines. It is stated by M. Carrière to have been found by Hartweg in Mexico in 1840, and to have been then sent home by him; but he does not appear to have met with it in his second expedition in 1845 and following years, as it is not named in Bentham's “*Plantæ Hartwegianæ*,” which is the record of the plants procured by him on that expedition. It was subsequently introduced into this country by M. Roetz.

Properties and Uses.—This species is probably applied to similar uses to those of its allies, *Pinus Strobilus*, &c. We have no information on the subject, except Gordon's statement that the wood is white and soft, and Messrs. Henkel and Hochstetter's addition, probably an inference by way of corollary, that it is little worth. But there is a hint given by the name “Tablas,” which, according to Mr. Gordon, is applied to the tree by the inhabitants of Santa Maria and its neighbourhood; which would seem to indicate that it perhaps deserves a more favourable character. “Tablas,” in Spanish, signifies the wood out of which tables and similar articles of furniture are made, as well as the articles themselves. We may, perhaps, therefore be entitled to infer that it is used by the inhabitants for upholstery and carpentry purposes. The seed is too small to be of use as an article of food.

Culture.—It cannot be condemned as a tree wholly unfitted for this country; still less can it be called perfectly hardy. Messrs. Henkel and Hochstetter say that it stood the severe winter of 1860–61 in England unhurt. Mr. Palmer's tables tell a different tale. They contain reports of the worst effects of that winter on this tree at sixteen places. At seven of these the tree was killed, at five uninjured, at two much injured, and at two less injured. There are, of course, few large trees in this country, although the one in Messrs. Paul's nursery at Cheshunt, from which the figure above cited was taken, is of considerable height (say 36 feet), and in 1882 bore numerous cones. One of the trees killed in 1860–61 was at Thorpe Perrow in Yorkshire, and it had reached 16 feet in height, and another at Highnam Court, Gloucestershire, was 14 feet in height. It was observed at Ashdean, in Sussex, that it did not seem to mind the cold so much, but that it suffered severely from salt winds from the south-west. At Castle Kennedy it escaped without injury, and grows freely in a well-sheltered situation.

Commercial Statistics.—Price in 1851, small plants 21s. each. It is not quoted in any catalogues of recent date, nor is it named in the list of seeds of MM. Vilmorin of Paris, at the end of this work.

PINUS BALFOURIANA.

FOX-TAIL PINE OF NEVADA.

IDENTIFICATION.—PINUS BALFOURIANA, *Oregon Committee's Circular* (1852); Gordon, *Pinetum*, 217 (1858); Engelmann in *Revision of Genus Pinus*, p. 19, and note 6, and in *Bot. of California*, ii. p. 125; *Gard. Chron.*, March 11, 1876, p. 332.

PINUS PARRYANA, Parlatores, cited by Gordon, *Pinetum*, ed. 2 (1878), p. 293.

PINUS QUADRIFOLIA, Parry, cited by Gordon, *Pinetum*, ed. 2 (1878), p. 293.

ENGRAVINGS.—Cone, Seed, and Leaves; *Gard. Chron.*, loc. cit.

Specific Character.—Pinus foliis quinis singulis falcatis brevibus; vaginis caducissimis; strobilis fuscis elongatis attenuatis sub-pyriformibus parum curvatis, squamis sub-laxis, apophysi tetragono umbone transversim elliptico depresso; seminibus alatis, spermodermate maculato.

Habitat in California boreali.

A tree of about 80 feet high (seldom over 50, Engelmann). Branches said by Mr. Gordon to be pendulous and flexible (causa scientiæ non patet), bark smooth (deeply fissured, Engelmann), and reddish,

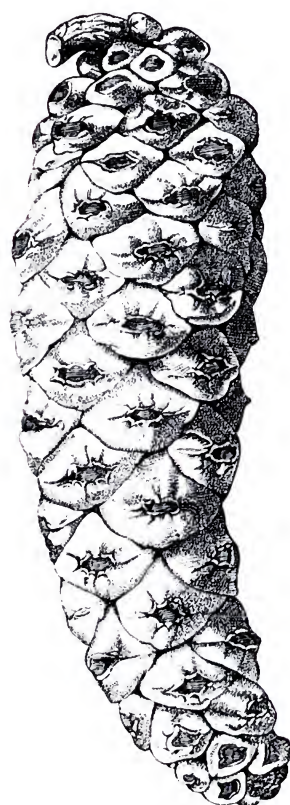


Fig. 5.

leaves in fives (fig. 1), but varying upon the same shoot, there sometimes being only four, sometimes only three, and occasionally as few as two in the sheath. They are crowded on the branch, trigonal, short (about 1 inch long), ridged and slightly falcate, or curved inwards, without stomata on the back (fig. 2), with several rows on each of the inner sides (fig. 3). The margin is entire; sheaths caducous, composed of long scales; the hypoderm is double and the resin canals (fig. 4) peripheral; inflorescence not yet known; cones long (4 or 5 inches), tapering, and sometimes pear-shaped, but more blunt at the end (fig. 5), dark-brown, said by Mr. Gordon to be mostly solitary and pendent on the points of the branches and full of resinous matter; scales thin, flattened, with the apophysis tetragonal, depressed in the centre, in which is a transversely elliptical umbo. Seeds winged (fig. 6); wing large, straight at the back, and with a broad, bold curve on the other margin. Seed moderately large, projecting a little backwards from the wing; spermoderm maculated.

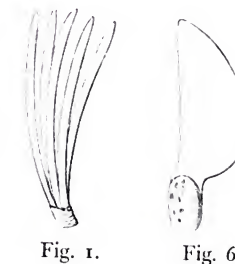


Fig. 1.

Fig. 6.



Fig. 3.

Fig. 2.



Fig. 4.

Description.—We know nothing more of the appearance of this tree than the brief notices given by Jeffrey, that it grows to a height of 80 feet with a diameter of 3 feet. In his "Revision of the Genus Pinus" (1880), Engelmann states that this and *P. aristata*, in spite of the differences in the cones, are identical. In Utah and Nevada a form occurs with cones like those of *P. aristata*, but with short stout recurved prickles.

Geographical

PINUS BALFOURIANA

Geographical Distribution.—The range of this species is apparently restricted. It has been met with on the mountains between Shasta and Scots Valley in Upper California, N. lat. $40^{\circ} 30'$ to $41^{\circ} 50'$, at an elevation of between 5000–8000 feet, and, according to Engelmann, on the head waters of King and Kern rivers, and on Mount Whitney.

History.—It was found by Jeffrey in the above locality in 1851, and a few seeds were forwarded to this country. Very few of these grew.

Properties and Uses.—Unknown.

Culture.—The plants which have grown have received no special care or unusual treatment.

Commercial Statistics.—Not in the market.

PINUS BUNGEANA

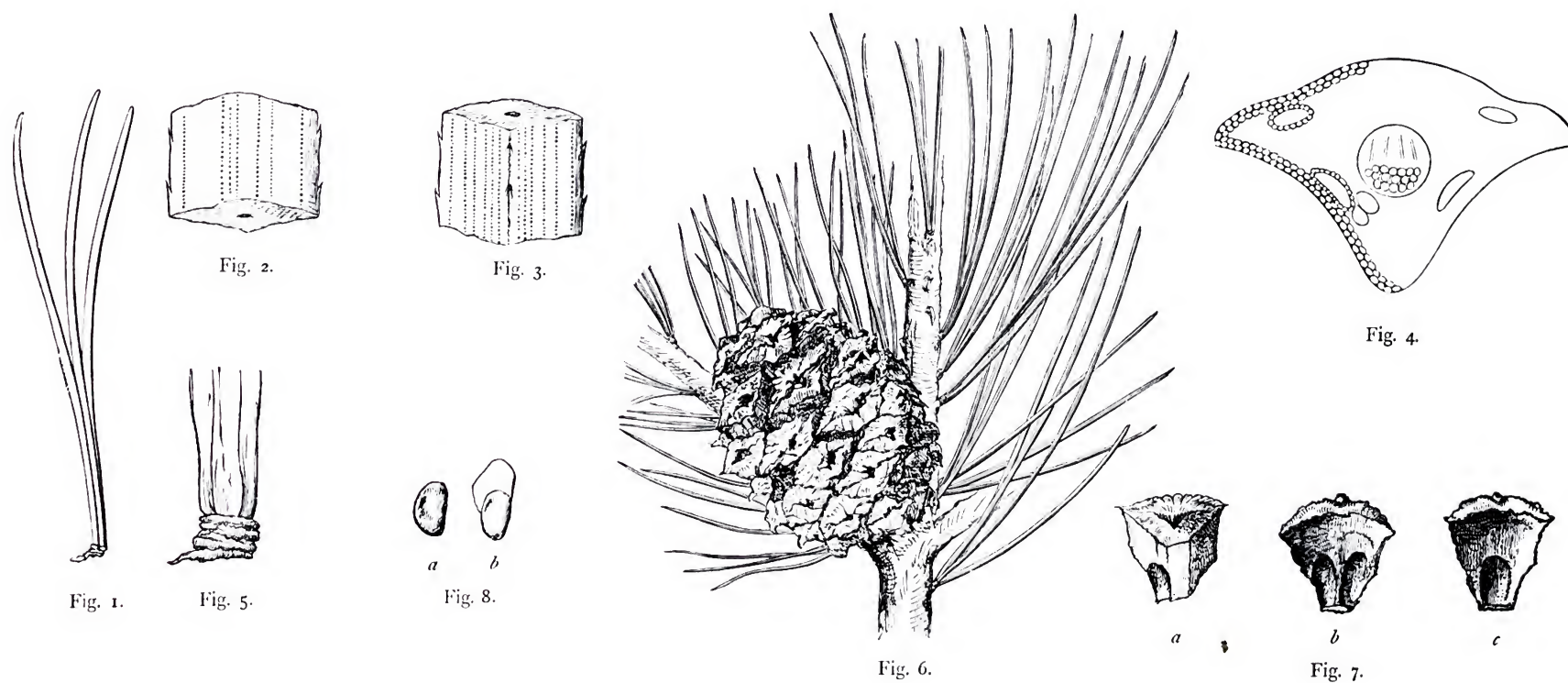
Pah-be-sung—WHITE-BARK PINE ; THE CHINESE LACE-BARK PINE. *Kien-lung-mu*—SKIN- OR BARK-SHEDDING PINE.

IDENTIFICATION.—PINUS BUNGEANA. Zuccarini, Gordon, *Pinctum*, p. 190 (1858), and *Supplement*, p. 64 (1862); Engelmann, in *Revision of Genus Pinus* [177], 17; Parlatore, in *D. C. Prod.*, xvi., pt. 2, p. 398.
PINUS EXCORTICATA. Gordon, *Pinctum*, p. 190 (1858), and ed. 2 (1875), p. 263.

Specific Character.—Tæda foliis ternis modicis rigidis strictis, vaginis cito deciduis, strobilis conico-ovatis obtusis squamarum apophysi parum elevato, transversim carinato prope marginem superiorem, umbone parum depresso cum tuberculo reflexi brevi et robusto.

Habitat in China boreali.

A tree of moderate size; branches long, slender, little divided, glaucous, and covered with a smooth light-grey bark, similar to that of the Weymouth Pine; rendered a little rough on the stem and older branches by the phyllulæ, which are rhomboidal. When the tree becomes older the bark peels off, leaving the stem and branches of a white colour, whence the Chinese name. Buds not resinous, and formed of several reddish-brown smooth-fringed scales, largest at the base, and rough at the edges. Leaves in threes (fig. 1), very stiff and strong, convex on the back, and keeled on the inner face, serrulated on the margins, and keel 2 or 3 inches long, and thickly placed along the young shoots; frequently in bundles towards the ends of the branches, somewhat in whorls, with stomata both on the back and on the inner sides. On the back (fig. 2) there is one row of stomata next the margin, then a vacant space, in which is usually a hollow line in the dried specimens. Beyond this there are two, three, or even four rows on each side of the middle, but two or three is the commonest number. On the inner sides (fig. 3)



there is a single row near the outer margin, then a small space, then two rows, then another space—which is usually raised in the dried specimens—then three more rows next the keel. On section (fig. 4), a single

PINUS BUNGEANA

layer of hypoderm may be seen with peripheral resin canal, transversely elongate (not circular) in section, and surrounded by strengthening cells. Sheaths short (fig. 5), composed of numerous loose scales, which soon fall off, and leave the base of the leaves naked, a character which readily distinguishes this species from any which are likely to be confounded with it. Male catkins, from 5 to 6 inches long, cylindrical or conical when young, placed alternately at the base of the young shoots, but frequently afterwards very distant, owing to the rapid elongation of the young shoot. Cones (fig. 6) ovate or slightly conical, broadest near the base, about $2\frac{1}{2}$ inches long when at maturity, and $1\frac{1}{2}$ inch in diameter, and terminating obtusely. Scales (fig. 7, *a*, *b*, *c*), with the apophysis, from $\frac{1}{2}$ to $\frac{3}{4}$ inch across, and 4 lines deep; concave with a slightly elevated keel or ridge transversely placed across the scale near the upper margin, and furnished in the centre with a short, stout, reflexed point, a little sunken. The scales near the base of the cone are very much smaller and more numerous. The seeds leave a very deep impression on both sides of the scale, and even the traces of the outlines of the wings are left. The seeds (fig. 8) are placed somewhat irregularly, usually two to each scale, but not rarely only one. The wing of the seed is very short (fig. 8 *b*), not so long as the seed itself, and somewhat parallel and obliquely rounded at the apex. The seed itself (fig. 8 *a*) is roundish, with the back straight, and the other side obliquely rounded off, both at top and bottom.

Description.—The character and habit of this tree is very marked, and peculiar to itself. In the young state it is chiefly distinguished from its allies by its light-grey bark, and the absence of sheaths to the bundle of leaves. But when of mature age, and grown to its full size, its characteristics are much more remarkable. Its bark peels off, as in *Arbutus Andrachne*, leaving the stem and branches nearly white, producing, as may be supposed, a very peculiar effect. The tree, too, grows with a straight stem to the height of about 8 or 10 feet, and about 2 feet in diameter, or a little more. From this springs a multitude of branches, not spreading out horizontally or divergently, as in other trees, but rushing straight up to a great height. It is like a pollard, only that the branches grow all straight up. After reaching a certain height they branch out, forming a top or head of the tree. This singular habit, the late Mr. Fortune assured us, is natural, and not produced by artificial means—a point, however, which perhaps he had scarcely materials for deciding. Where he saw them, these large trees were generally in cemeteries in opposing pairs, and he refers the choice of this tree for that purpose to its peculiar habit; but it is quite as possible that it may have been selected from its tendency to assume this form under particular treatment. We have an example of such a tendency in the variety of *Picea Apollinis*, called by Dr. Heldreich *Abies Regina Amaliæ*, in which a crowd of young branches spring up from the stumps of trees which have been cut down. The trees, also, which Mr. Fortune saw, were not less than two hundred years old, so that any trace of pollarding may have long since been obliterated. However, we allow that Mr. Fortune was not likely to be mistaken on such a point, and he spoke with confidence of this being the natural habit of the tree, and not an artificial effect of manipulation.

History.—First described by Zuccarini, and afterwards by Mr. Gordon. He gives “Kien-lung-mu” as its Chinese name (*lung* being, without doubt, a misprint for *sung*, or Pine-tree), which he interprets to mean Bark-shedding Pine, or Lace-bark Pine. Mr. Fortune, who introduced it, and had ample opportunities of learning, and the knowledge requisite to acquire its native name, informed us that he never heard it so designated, but always called “Pah-be-sung,” *pah* signifying white, *be* bark, and *sung* being the generic name for Pine-tree. There is no ground whatever for calling it a lace-bark tree, the bark not peeling in fibres with bast-like interstices, so as to warrant such a name, which he considers must be a European misapprehension or misinterpretation.

Geographical Distribution.—The native habitat of this tree is far to the north of China, between Peking and the Western Hills, one of the coldest and most desolate-looking districts in winter which an
inhabited

PINUS BUNGEANA

3

inhabited and cultivated country can well be. In summer the country, although treeless, is not without vegetation. Its plains are covered with crops of a kind of millet—a tall Sorghum, from 6 to 9 feet high, with a hard stem as thick as a man's thumb, which in autumn is cut about knee-high, and which did infinite damage to the legs of our cavalry horses in the Peking war; and the gardens and neighbourhood of the houses of the inhabitants are gay with flowers and shrubs. But in winter all is changed: the crops being cut down, the plains are one extensive stubble; not a plant nor a tree to break the uniform desolate sameness is to be seen so far as the eye can reach, all the shrubs and plants having disappeared. Where they can have gone to at first appears inexplicable; but on inquiry it turns out that they have been taken up and carried in pots into outhouses, into cellars, and holes under ground, and wherever shelter can be obtained from the severity of the coming storm, which would otherwise kill them all. The hardiest evergreen cannot unprotected stand that piercing climate. Passing through these inhospitable regions to the mountains to the west, Mr. Fortune first met with this Pine, in its native country and full grown. In the south he had often seen small plants in pots, and knew the tree perfectly; but when he saw the strange aspect of the tree with its white leaves, as above described, he naturally rejoiced at the discovery of a new species. It was only when he came up to it that he found it was an old acquaintance. Being almost confined to cemeteries, and in such a treeless country, its lofty, white, many-pillared columns, so associated, formed an impressive and striking object.

Properties and Uses.—Not yet known to possess any peculiar economic value not possessed by the whole family of Pines.

Culture.—Looking at the bitter cold of the country from which this species comes, it was of course to be expected that it would prove hardy in our own milder climate, and so it has proved. It stood the cold of the winter of 1860–61, as well as those of 1878–79, 1880–81, uninjured, and seems to be tolerably rapid in its growth.

Commercial Statistics.—Price of young plants in 1862, 10s. 6d. to 15s.; in 1872, 5s. to 10s.; in 1882, 2s. to 7s. 6d.



PINUS CEMBRA.

PINUS CEMBRA.

CENBROT, EOUVE, TINIER, of the French; ALVIES, ARTH, of the Bernese Swiss; APIHERNOUSLI of the Tyrolese; ARALLO of the Savoyards; ARVEL, ARVE, ZARBEL, ZURBEL, ZIERRUSS, LEINBAUM, of the Germans; LIMBOVE DREWO of the Slavonians; LIMBA of the Poles; TZIRBOLYA of the Hungarians; KEDR of the Russians; KUSSOCH, KUSSUCK, KUSU AGATSCH, of the Siberian Tartars.*

IDENTIFICATION.—PINASTER, Belon, *Conif.*, p. 19 (1553); Micheli, *Nov. Gen.*, p. 223 (1729).

PINUS SYLVESTRIS ASPECTU PICEÆ SED FOLIIS PINI, NUCLEIS FRAGILIBUS, Cæsalpinus, *De Plant.*, iii. p. 52 (1583).

PINUS SYLVESTRIS CEMBRO, Mathiolus, p. 102 (1586); Camerarius, *Epit.*, p. 42 (1694).

PINUS SYLVESTRIS ALTERA, Dodoens, *Pempt.*, p. 160 (1616).

PINUS CUI OSSICULA FRAGILI PUTAMINE s. CEMBRO, Bauhin, *Hift.*, ii. p. 250 (1651).

PINUS SYLVESTRIS MONTANA, C. Bauhin, *Pinax*, p. 491 (1623).

PINUS FOLIIS QUINIS TRIQUETRIS, Haller, *Helv.*, n. (1659).

LARIX SEMPERVIRENS, FOLIIS QUINIS, NUCLEIS EDULIBUS, Breyn, in *Ephemer. Nat. Cur.*, cent. vii., obs. ii. (1719).

PINUS SATIVA, CORTICE FISSO, FOLIIS SETOSIS SUBRIGIDIS AB UNA THECA QUINIS, Amann., *Ruth.*, p. 178 (1739).

PINUS FOLIIS QUINIS, CONO ERECTO, NUCE EDULI, Gmelin, *Flor. Siber.*, i. p. 179 (1747-69); Duhamel, *Arbr.*, ii. p. 127, n. 30 (1804).

PINUS MONTANA, Lamarck, *Flor. Franc.*, iii. p. 697 (1793).

PINUS CEMBRA, Linnæus, *Spec.*, p. 1419 (1753); Pallas, *Flor. Ross.*, i. p. 3 (1784); Allioni, *Flor. Pedem.*, ii. p. 179 (1785); Villars, *Flor. Delph.*, iii. p. 806 (1789); Willdenow, *Baumz.*, p. 212 (1796); Hoft, *Synops.*, p. 523 (1797); Du Roi, *Harbk. ed Pott.*, ii. p. 69 (1800); Lambert, *Genus Pinus*, ed. 1, i. p. 34 (1803-24); Decandolle, *Flor. Franc.*, iii. p. 275 (1805); Desfontaines, *Hift. Arb.*, ii. p. 612 (1809); Wahlenberg, *Flor. Carpat.*, p. 309 (1814); Baumg., *Flor. Transylv.*, ii. p. 304 (1816); Loiseleur, *Nouv. Duham.*, v. p. 248 (1819); Lambert, *Genus Pinus*, ed. 2, i. p. 48 (1828); Gaudin, *Flor. Helv.*, vi. p. 186 (1830); Hoft, *Flor. Aufl.*, ii. p. 629 (1831); Ledebour, *Flor. Alt.*, iv. p. 200 (1833); Lawson, *Agric. Manual*, p. 358 (1836); Loudon, *Arboretum*, iv. p. 2274 (1838); Forbes, *Pinet. Woburn.*, p. 69 (1839); Antoine, *Conif.*, p. 45 (1840-46); Link, in *Linnaea*, xv. p. 513 (1841); Loudon, *Encycl. of Trees*, p. 1016 (1842); Spach, *Hift. Nat. Veg. Phaner.*, xi. p. 398 (1842); De Chambray, *Traité Prat. Arb. Rés. Conif.*, p. 334 (1845); Endlicher, *Syn. Conif.*, p. 141 (1847); Knight, *Syn. Conif.*, p. 34 (1850); Lindley and Gordon, in *Journ. Hort. Soc.*, v. p. 214 (1850); Lawson, *Abietineæ*, p. 24 (1851); Carrière, *Traité Gén. des Conif.*, p. 295 (1855); Gordon, *Pinetum*, p. 219 (1858); and *Supplement*, p. 67 (1862).

PINUS CEMBRA, VAR. A. COMMUNIS, α VULGARIS, et β HELVETICA; Clairville, *apud* Gaudin (*loc. cit.*)

ENGRAVINGS.—*Cones, Leaves, &c.*—Micheli, *Nov. Gen. (loc. cit.)*, t. 19; *Ephemer. Nat. Cur. (loc. cit.)*, t. 1, fig. 3 and 5; Duhamel, *Arb. (loc. cit.)*, t. 32; Loiseleur in *Nouv. Duham. (loc. cit.)*, t. 77; Lambert, *Genus Pinus*, ed. 1 (*loc. cit.*), t. 23; ed. 2 (*loc. cit.*), t. 30 and 31; Forbes, *Pinet. Woburn. (loc. cit.)*, t. 27; Loudon, *Arboretum (loc. cit.)*, figs. 2188 to 2191 incl.; Loudon, *Encycl. of Trees (loc. cit.)*, fig. 1902 and 1905; Antoine, *Conif. (loc. cit.)*, t. 20, f. 2.

Trees.—Loudon, *Arbor. Brit. (loc. cit.)*, fig. 2192, and vol. viii. pl. 376.

Specific Character.—Pinus foliis quinis interdum quaternis vel fenis teneris marginibus valde serrulatis, strobilis faturate violaceo-brunneis vel virentibus ovatis obtusis basi subumbilicatis, squamis cuneatis, apophysi dimidiata late rhombea obtusa margine plana vel subreflexa, umbone terminali late lanceolato, antherarum crista reniformi crenata, feminibus apteris testa brunnea vel subfusca.

* Endlicher (*Syn. Conif.*, p. 142), gives the following local or provincial names of this tree among the various Asiatic tribes, viz.:—"Syra et Njarga, *Tomenfibus*; Sus-pu, *Permecis et Sircenis*; Taet, *Vogulis*; Olba, *Vogulis ad Tschuffocajan*; Ulpe, *ad Sofcam*; Laegal, Liggat, *Ostiacis*; Ilgat, *Vassuganis*; Tiddi, *Samojedis Obensfibus*; Tiddok, *ad Ketam*; Tyri, *ad Ieniscam*; Tydeng, *Samojedis monticolis*; Tjadyng, *Camafchis*; Imp'hai, *Arinzis*; Py, *Affinibus Pumpocolienfibus*; Hai, *Inbazkienfibus*; Pei, *Affjanis*; Cutschi, *Burdetis*; Chofchi, *Mongolis*; Taktykan, *Tungufis*."

PINETUM BRITANNICUM.

Habitat in toto Alpium jugo, in Carpathis, in jugo Uralensi, per omnem Siberiam borealem et alpinam frequens, alt. 4000 to 6500.

A handsome tree, of large size; most pleasing to the eye from its rich dark-green foliage. Branches tortuous; foliage irregular; bark griseous, scabrous, and hoary. Leaves from 2 to 3 inches long, usually



five, sometimes four or six, in the sheath [fig. 1], scarcely half a line in breadth, very dark green, stiff, triangular, with a sharply prominent keel, convex on the back, ferrulated on the edge and keel so as to feel rough when drawn forwards through the fingers [fig. 2], rendered silvery on each side of the keel by from three to five irregular rows of stomata [figs. 3 and 4], the back without stomata; the stomata small and not very close together; the base of the sheath cortical, hard, scarcely two lines in length; the sheath itself is two lines in length, composed of several linear, spatulate, obtuse, membranaceous, dry, brown scales, at first combined into a kind of imbricated sheath, soon falling loosely open and dropping off. Fig. 5 shews the base of the leaves and their insertion. Male catkins [figs. 6 and 7] short, brownish violet-red, subterminal, clustered

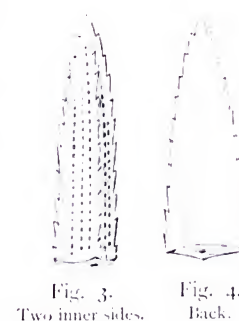
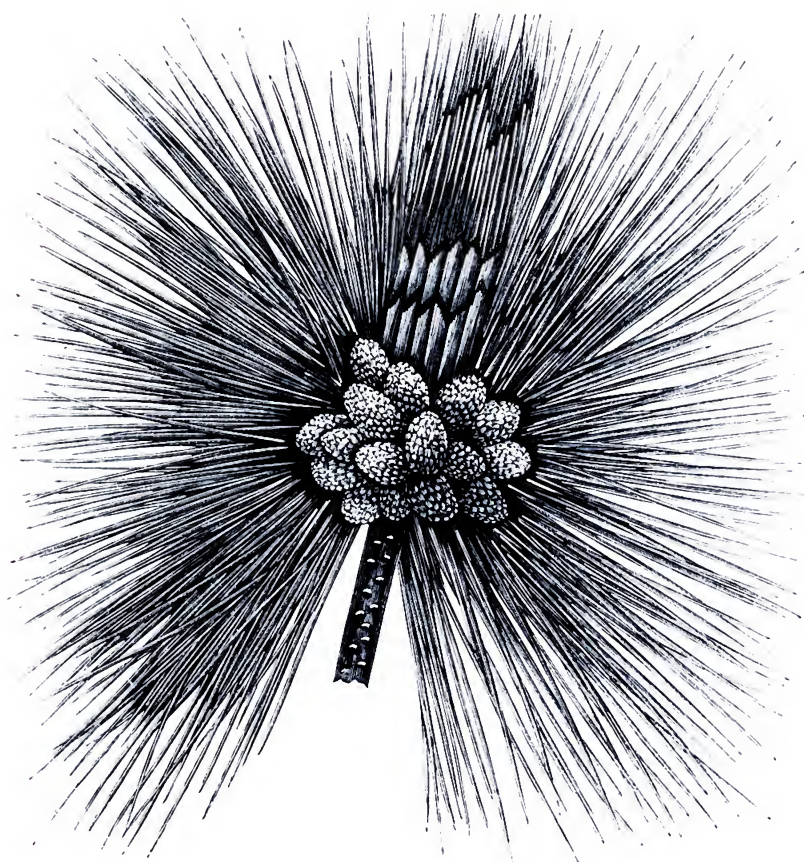


Fig. 4.
Back.



together, 5 to 8 lines long, oblong-cylindrical, very obtuse, provided with a sort of calyx composed of oblong, obtuse, thinning brown bracts at the base. Anthers bilocular, sulphur yellow, with the margins and connexion of the loculi red, the latter produced into a short reniform emarginate sharply crenulated crest, of the same colour [figs. 8 and 9]. The pollen is so abundant, that when the tree is in



flower, the ground under the tree seems to be covered with yellow dust. The young cones are at first terminal, concealed among the leaves, ovate, oblong, violaceous or greenish, often hoary or glaucous; afterwards when full-grown they become axillary, in consequence of the subsequent growth of the surrounding branchlets: they are sessile, erect, oval, obtuse, generally from two to three inches long, rarely assuming a somewhat cylindrical form. Scales [figs. 10 and 11] with the apophysis somewhat convex, rather smooth and adpressed, sometimes longitudinally rugose, with the margins narrowly reflexed when matured, terminating in a broad obtuse umbo; the base broad, wedge-shaped, deeply excavated on the inner side for

PINUS CEMBRA.

3

for the reception of the seeds, and also on the back by the pressure of the seeds behind it. The seeds wholly apterous [figs. 12 and 13], obovate, acute at the base, very obtuse at the apex, convex and gibbous on the back, the remainder flattish, the test or shell thick osseous. Cotyledons from 6 to 13 in number [fig. 14].

Description.—In its native country this tree reaches the height of 120 feet, when it becomes a magnificent object; a tall pile of foliage, with a fine rounded oak-like top. In Britain it scarcely exceeds 50 feet, which may perhaps be owing to the fact that it is a slow-growing tree, and the oldest trees here are only about 115 years old. In the earlier stage of its growth it is an erect pyramidal tree, distinguished by its dark-green foliage, with silvery gleams from the argenteous sides of the leaves. To our eye it is a most beautiful tree. All tastes are not alike, however. Perhaps it needs an instructed eye—an eye educated in firs—to appreciate its beauty. A writer in the ‘Edinburgh Review’ (October 1864), speaking of the comparatively late period at which this species was introduced into Britain, and which he thought was to be accounted for by its having been confounded with the Scotch Fir, relates the following anecdote:—“The most important of the neglected species was the Cembra, a tree which, although it appears to our eyes distinct enough from the Scotch Fir, has yet sufficient general resemblance to render it probable that it may have been mistaken for it. True, its leaves are five instead of two in the sheath, less rigid, of a darker green, with a beautiful silver lining, which gives a peculiar hoary character to the foliage when moved by the wind; the cone is also quite different, and the seeds are large, wingless, and good to eat, forming an agreeable nutty-flavoured addition to the food of the inhabitants of the countries in which it grows. But we have heard of the two being confounded in our own times under circumstances which may make us very lenient to any similar mistake in the days of our ancestors. A nobleman in the west of Scotland, some twenty years ago, possessed a grove of Cembras of greater age and beauty than were to be found anywhere around. They were the pride of his heart and the delight of his eyes. They had been planted along with Scotch Firs which had served as nurseries, but were now mostly removed, although, being of more rapid growth than the Cembras, such as remained had overtopped them. He had got a new gardener or forester just at the time that he was obliged to leave his country residence to attend to his duties in Parliament. Being, however, more of a country gentleman than a politician or statesman, he hurried home as soon as possible, and one of the first visits after his arrival was to his cherished grove of Cembras. Slowly and benignly he paced up the hill like one prolonging the pleasure of anticipated enjoyment. He came down more quickly, and less benignly—not benignly at all, indeed; for when he reached the angle where he should have come in view of his grove, he looked for the Cembras in vain. He started, stared, and rushed forward; not a Cembra was there; the Scotch Firs were left alone in their glory; and there stood the new gardener smug upon the spot, with the well-satisfied smirk of one who had deserved well of his master—the *mens conscia recti* beaming on his countenance—ready to claim the meed of gratitude for having so well thinned out the grove. Believing the Cembras to be merely smaller firs, he had cut them down, and left nothing but the taller Scotch Firs. A little knowledge is a dangerous thing. The honest man had heard that in thinning it was wise to take the weak and leave the strong, and had acted upon it, without suspecting that he was dealing with two different quantities.”

Mr Maxtone Graham of Cultoquhey, near Crieff, in Perthshire, has a very fine specimen, of unusually close habit and erect growth (the variety called by Carrière *P. Cembra stricta*), which suffered in a somewhat similar way from the predilections of his gardener years ago. It encroached upon a neighbouring blackberry bush, and the gardener pruned it year after year to give space to his blackberry bush. The tree is a specimen one which coniferous enthusiasts come from a distance to see; but it still bears a slight hollow in its side, marking the place where it was cut away to make room for its more favoured rival. There are educated eyes, however, which see no beauty in the Cembra. Even Mr Loudon speaks of it as formal and not handsome. He says, “Though we hold it to be scarcely possible for a pine to be otherwise than ornamental (if it were for no other reason than its being an evergreen), yet we cannot help

PINETUM BRITANNICUM.

4

considering the Cembra Pine, when compared with other species, as rather monotonous, both in form and colour. The summit of the tree, however, and its purple cones, we acknowledge to be very beautiful. That we may not run the slightest risk of injuring the tree, we may mention that Mr Lambert, so far from entertaining the same opinions as we do respecting it, looks upon it as one of the handsomest trees of the genus *Pinus*" (ed. 2, i. p. 49). In this we heartily agree with Mr Lambert. It is a tree of slower growth than most other firs, seldom growing faster than one foot in a year. Loudon records a tree at Whitton, planted by the Duke of Argyll in 1746, as the largest in England in 1837, and this, although 91 years old, was only 50 feet in height, with a trunk 18 inches in diameter at the base.

Geographical Distribution.—The nearest points to England where the Cembra is found growing wild, are the mountains of Dauphiné in France, and the Alps in Switzerland. In the former it is rare, but becomes more plentiful as we advance towards the east. It is found in all the Alps; in the Carpathian Mountains; in France, Italy, Austria, Syria, Hungary, and Transylvania. The elevation above the sea at which it is usually found, is from 4000 to 6500 feet. An enthusiast in trees, Sir John Nafmyth of Dalwick, thus writes us of the Cembra in its native land: "Since my residence abroad I have purposely visited many of the celebrated tree districts—for instance, in the Upper Inn Valley. You can have no idea of the Larch and *P. Cembra* (commonly, or rather always, called by its more beautiful name the Arve—the *e* pronounced *a* long). Amongst the Bernina Alps and glaciers I have been tired of measuring Larch and Arven 12, 15, 18 feet in circumference; some 12 feet in circumference at my height from the ground! The Arve attains a noble rounded top, and is literally the *oak* of the pine forests." It extends into Asia, forming vast forests in Siberia and the Tartarian Mountains. Its exact limits in Asia, however, are not known, but the long list of provincial synonyms above quoted from Endlicher shews that its range must be very great. Regel, in his "Tentamen of the Flora" of the Uffuri region, says that it is found "about the mouth of the Uffuri, on the northern declivity of the Chechtys ridge, near Surmé. It is not rare in mixed woods. Specimens were gathered in flower in the beginning of June."

He states that in the region of the Uffuri only the typical form of *P. Cembra*, with rough-edged leaves, is found. From the Amur country, on the contrary, only the species called by Pallas *P. pumila*, and by Regel *P. Mandshurica*, is known. This is a perfectly substantive form, characterised by its retaining its bushy habit even in cultivation, and shewing, by producing cones, that this is not due to want of maturity. It has other distinctive characters, which will be found under the description of that species; for we agree with Professor Regel in regarding it as distinct, and have consequently not quoted the synonyms usually given of that variety under the head of this species.

We believe that there is a third form of the Cembra (which, however, we have not seen) which occupies the country between the Swiss Cembra and the Kamtschatkan and Amourian species. Pallas first drew attention to it, and states that it is not found beyond the Lena. Sir Roderick Murchison informs us that the species which he saw in the Ural Mountains was distinct from the Swiss species. It is doubtless the Siberian species mentioned by Pallas; and this gives us probably the western limit of that species or variety.

This, however, is not the variety known among horticulturists as *Pinus Cembra Siberica*, which is merely an unusually luxuriant and long-leaved form of the common species. The rows of stomata on the leaves of this Siberian variety are on the whole more numerous than in the ordinary form—4 or 5 instead of 3 or 4. In other respects we see no distinction between them.

The Cembra is represented in North America by *Pinus flexilis*, and in Mexico by *P. Cembroides* and *P. edulis*. There are other species which belong to the Cembroid section in Japan and Mexico, but they constitute a distinct sub-section of it.

History.—This tree is so well marked, and its cone so different from the Scotch Fir, that it is not surprising that it has been known as a distinct species from the earliest times. Its first introduction into this country

PINUS CEMBRA.

5

country was probably due to the Rev. J. Harte, who, in 1746, published "Effays on Husbandry," in which it was strongly recommended. Archibald, Duke of Argyll, in the same year, planted a number of trees at Whitton, from one of which the dimensions above-mentioned were taken. Numerous plants introduced about the end of last century are to be seen at Walcot Hall, near Shrewsbury; and at Gledhow, near Leeds, many trees were planted at the same time, probably both being part of a large importation of seeds, mentioned by Lambert as having been then made. These latter trees attracted the notice of horticulturists more than those at Whitton or Walcot Hall, and procured for the species the provincial synonym of the Gledhow Pine. In 1837, Loudon mentions that these trees were of small dimensions, most of them going to decay; their height being only 35 feet, after having been planted 45 to 50 years.

In 1828 Mr Lawton brought from Switzerland some seeds which he dispersed throughout Scotland for experiment, and in 1833 we imported the first large supply of seed which had been brought to this country in the present century. From that importation many places, both in Scotland and England, which now possess fine young trees, were supplied. Those at Hopetoun House and at Ormiston Hall are especially worthy of attention.

Properties and Uses.—The fragrance of this tree is delightful, whether smelt in passing through its forests or merely from hand specimens of branches, or even from the wood itself; and the perfume, although so agreeable to man, is said to be so offensive to bugs or moths as to deter them from infesting rooms where it is used. It endures also for years, Kaffhofer says for centuries. An apartment wainscoted with Cembra, or, more moderate still, a library with its shelves of that wood!—*hoc erat in votis*; but in this country trees large enough for this purpose are not to be had, or at least are not to be cut down; and importations from the Alps are expensive. The heart-wood is of an agreeable light-brown colour, and very soft and easily worked. It is of it that the paper-cutters and little pieces of ornamental wood-carving from the Righi are made; and the well-known little Swiss toy figures of men and animals are carved out of it by the shepherds of the Cantons and the Tyrol. For the more serious wants of life it is chiefly used for upholstery and carpentry work.

Its seeds are good to eat, having a pleasant nutty flavour; and are not only eaten by the common people in the districts where it abounds, but are there also placed on the tables of the rich as a dessert, either shelled or in their nuts. We read that in Siberia the seeds are sometimes produced in immense quantities, when the peasants almost live upon them during the winter; in other seasons scarcely a cone is to be found. Loudon narrates that the seeds are used medicinally, and refers to a story related by Gmelin of two captains of vessels who were suffering dreadfully from scurvy, and whose crew had almost all died of that disease, being cured in a few days by eating abundantly of these seeds. As the same result would have followed the abundant use of any other fresh vegetable, this can scarcely be cited as a property peculiar to the Cembra, and it is therefore unnecessary to waste time in settling whether the actual cure was effected by seeds of the true Cembra or of the *P. Mandshurica*, which Gmelin reckoned as only a variety of it.

An oil is expressed from these seeds, which in the Tyrol, &c., is used both as an article of or addition to food and for lamps. It is said to be yielded in great abundance, double the quantity (5 oz.) being obtained from a pound of its seed which can be produced from a pound of flax seed (2½ oz.) It has a very agreeable flavour when newly made, but soon becomes rancid.

The shells of the seeds when digested in spirits yield a fine red colour.

Culture.—The climate of Britain agrees well with this tree, although here it grows neither so rapidly as, nor has it yet reached the size of, the mature trees in its native countries. Mr Palmer's tables shew that none were injured during the winter of 1860. In its own mountains it grows in the very poorest soils, and on the barest rocks, where it would almost seem impossible for it to obtain a hold for its roots; but when it can get it, it by no means dislikes a good rich soil. It likes a dry subsoil. The following are the

dimensions of a few of these trees in different parts of the country. One at Walcot, in Shropshire (the Earl of Powis's), is 55 feet high and 60 or 70 years old, and the circumference of the trunk at four feet from the ground is 7 feet 2 inches; one at Osberton Hall, Nottinghamshire, was 50 feet in 1860; at Castle Ashby, Northamptonshire, 40 feet; at Linton Park, Kent, upwards of 40 feet in 1862; at Cultoquhey, near Crieff, Perthshire, 35 feet in 1863, and 40 years old; at Powis Castle, in Wales, 31 feet, and 40 years old; at Sudbury Hall, Derbyshire, 22 feet, and 30 years old; at Kinlet Bewdley, 27 feet, although only about 20 years old (an exceptionally rapid growth); at Bloxholm Hall, Sleaford, 30 feet, and 30 years old; at Sudbrooke Holm, Lincoln, 25 feet, and 30 years. There are three fine specimens at Balharrow, near Coupar-Angus.

As already mentioned, there are varieties in the habit of this tree. M. Carrière mentions in his *Treatise* four horticultural varieties—one with wider spread branches and more open foliage; another, which he calls *Pinus Cembra pygmea* of horticulturists, and not the *pygmea* of Fischer, which is the *Mandshurica* above mentioned. It is characterised by very short, slender, irregular, spreading, or bent branches, and short slender leaves of unequal length. He says that he saw a specimen at Dropmore in 1853, a plant more than twenty years old, which had only grown 35 centimetres in height. This was doubtless the same plant which is mentioned by Loudon in 1837 as growing at Dropmore, and having then been planted upwards of 20 years, and yet had not reached 6 inches in height. Loudon presumed it to be this variety. Carrière thinks not, and says its origin is unknown. From personal examination we can say that the specimen in question is not a variety of this species, but the true *P. Mandshurica*. It is still (in April 1866) only about 8½ inches in height, and Mr Frost, the garden superintendent there, informs us that he has remembered it over forty years, and he does not see much difference in its size now from what it was at the time he first saw it.

Loudon speaks of another specimen in Hopetoun Gardens, near Edinburgh, said to be upwards of 100 years old, and which in 1836 measured 5 feet 6 inches high. This may be the variety in question. We have been favoured with specimens believed to be of this tree, and can say that certainly none of them belong to the *P. Mandshurica*.

In a third variety, which Carrière calls *Pinus Cembra monophylla*, the five leaves stick together for the greater part of their length, or at least do not separate readily. It is said to be delicate. Lastly,



Fig. 15.

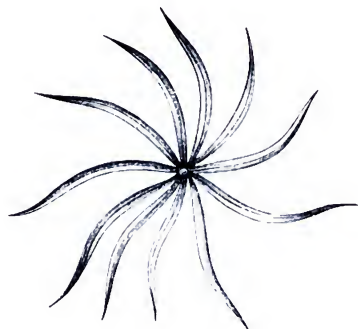


Fig. 16.

there is the straight-growing kind, which we have above referred to at Mr Maxtone Graham's, which has the habit of a bushy Irish Yew. M. Carrière speaks of having seen a specimen 30 feet in height which might compare with the Lombardy Poplar from its elongated form.

The seeds of this species should be sown as soon as possible after being gathered, or they will not come up until the following year. When not obtained until they have become dry by keeping, it is better to cover them with damp sand to remain over summer, by which they escape the ravages of mice, birds, &c. They should be sown the following winter, or at least not later than March. Fig. 15 is a young plant in the seed-leaf, and fig. 16 a diagram or plan of same.

Commercial Statistics.—Price of young plants in 1838, 6 inches high, 9d. each; in 1840, seed sold at 1s. 6d. per lb.; in 1850, the price of 1-year seedlings was 12s. per 1000, and 2-years 20s.; in 1866, 1-year seedlings 10s. 6d., and 2-years 15s. per 1000; the cost of seed at the latter date being 70s. per cwt.

PINUS COULTERI

IDENTIFICATION.—PINUS COULTERI. Don in *Linn. Trans.*, xvii. p. 440; Lambert, *Genus Pinus*, iii. p. 113 (1803-24); Loudon, *Arbor. Brit.*, iv. p. 2250 (1838); Loudon, *Encycl. of Trees*, p. 985 (1842); Forbes, *Pinet. Woburn.*, p. 67 (1839); Link in *Linnaea*, xv. p. 510 (1841); Antoine, *Conif.*, p. 31 (1846); De Chambr., *Trait. Prat. Arbr. Resin.*, p. 348 (1846); Endlicher, *Syn. Conif.*, p. 160 (1847); Carrière, *Trait. Gen. Conif.*, p. 335 (1855); Parlato in *D. C. Prod.*, xvi. 2, p. 393 (1868); Gordon, *Pinetum*, ed. 2, p. 266 (1875); Engelmann, *Revision of the Genus Pinus*, p. 17 [177] (1880).

PINUS MACROCARPA. Lindl., *Bot. Reg.*, Appx., p. 61 (1840); Lindl. and Gord., *Journ. Hort. Soc.*, v. p. 316 (1850); Knight, *Syn. Conif.*, p. 30 (1850); Gordon, *Pinetum*, p. 201 (1858), and do. *Supplement*, p. 66 (1862).

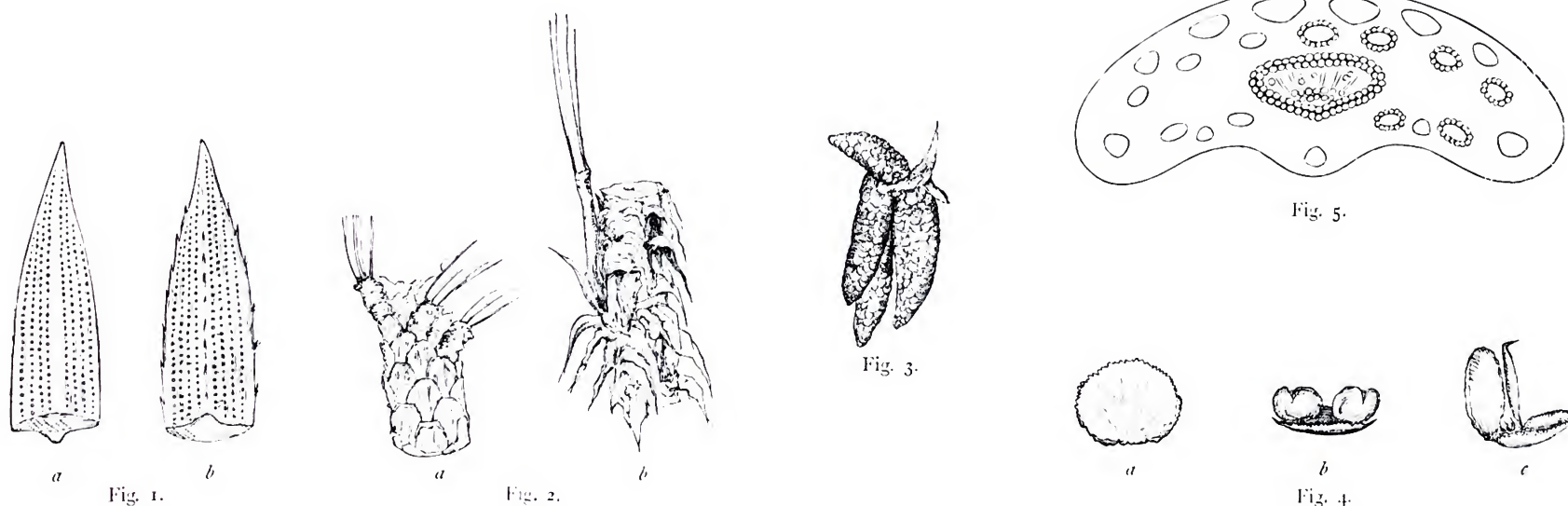
PINUS SABINA COULTERI. Loudon, *Encycl. of Trees*, p. 985 (1842).

ENGRAVINGS.—*Conc and Foliage*—Lambert, *Genus Pinus*, loc. cit., t. 80; Loudon, *Arbor.*, loc. cit., fig. 2144-2147; Forbes, *Pinet. Woburn.*, loc. cit., t. 25, 26; Antoine, *Conif.*, loc. cit., t. 12, 13; Loudon, *Encycl. of Trees*, fig. 1839-1841.

Specific Character.—Tæda foliis ternis quaternis vel elongatis sat fortibus (4-15 pollicares long.); vaginis (1 pollicare long.) laceris, ramulis crassis; pulvinis adpressis; strobilis oblongo-conicis (1 pollicare long.) squamis cuneatis apophysi ancipiti in umbonem longissimum (1½-3 pollicares long.), subulatum validum uncinato-incurvum continuo; seminibus ala quadruplo brevioribus.

Habitat in California in montibus St. Luciae (lat. 36° N.), altit. 3000-4000 pedes.

A large robust tree, reaching 80 or 100 feet in height, with wide-spreading branches open at the top. Branchlets reach an inch thick; pulvini short, decurrent, adpressed. Leaves in threes, occasionally in fours or fives, long, stout, compressed, rounded on the outer side, flat on the inner side with a raised midrib, sharp pointed, with the mucro a little to one side, with about eight stomata on the outer side of the leaf, and eight on the inner, disposed four on each side of the midrib; the edges and the midrib finely serrulated (fig. 1, *a*, *b*). The section is transversely oval with very thick hypoderm, resin canals numerous, parenchymatous surrounded by strengthening cells; bundle-sheaths of two rows of lignified cells; the sheaths (fig. 2, *a*, *b*) as thick as a crow's quill, and 1 or 1½ inch in length at first; afterwards they be-



come corrugated and short (the figure of them given by Loudon is wholly erroneous); the base is turned, and has three stiff cartilaginous glabrous lanceolate scales, one short one on each side, and a long one more than half an inch in length on the outside, all with fimbriated or lanceolate scales, which soon break off and leave the impressions, which become the phyllulæ and pulvini. Douglas says the scales are white, but in those we have seen they were brown, darkest towards the apex of the branch. Buds rather short, pointed, enclosed with adpressed scales covered with gum. Male catkins (fig. 3) numerous, in clusters, surrounding the

the young leaves at the end of the branchlets, about an inch in length, tapering and slightly bent, with a long stiff lanceolate fringed scale (fig. 4, *a*, *b*, *c*), at the base on the outside, the same as those at the base of the sheath of the leaves, and within this two smaller rounded broader membranaceous translucent scales. Stamens numerous, imbricated, spirally disposed, filament very short, expanding into the two loculi of the anther, open at the side and above, terminating in an expanded suborbicular membranous process with a subcrenulate margin. Cones very large, more than a foot in length, and half a foot in diameter, weighing about four pounds, conical oblong, with large hooked scales. The scales are wedge-shaped with an elongate lanceolate mucronate apex, compressed on both sides, sharp at the margins, obsoletely quadrangular in transverse section, incurved and hooked, very thick, hard, smooth, shining, fawn-coloured, from 1 to 3 inches in length, the lower ones longer, deflexed, and spreading, very closely adherent to each other. Seeds brown, irregularly oval, or sometimes with the back nearly straight, from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch in length, and $\frac{3}{4}$ of an inch in breadth without the wing; with the wing it is upwards of an inch in length. The wing is stiff, light brown, and nearly encloses the seed. The test or shell of the seed is hard, although not very thick, dark brown, and covered with a sort of yellowish-grey pulverescence. Cotyledons 10 or 11, irregularly trigonal in shape, very much compressed, almost pointed at the top, and broadly rounded at the base.

Description.—A tree very nearly allied to *P. Sabiniana*, growing to the height of 80 or 100 feet, with large spreading branches, and a trunk 3 feet or 4 feet in diameter. It is perhaps of a straighter habit and of a less glaucous hue. It produces the largest, heaviest, and most beautiful cone of any known species. The cone is like that of *P. Sabiniana*, with the scales terminating in large recurved hooks, but it is larger, longer, and the hooks of the cones more prolonged. Good specimens are rarely to be seen in this country, the projecting hooks of the scales being usually broken and injured, either in gathering or in course of transit. Mr. W. Murray mentions that two magnificent specimens ornamented his drawing-room chimney-piece in San Francisco for a considerable time; and notwithstanding the occasional use of fires when these were needed, the cones never shewed the slightest indication of opening, but seemed as if carved out of a solid block of wood. Indeed, the common observation made by non-botanical visitors was what an exquisite piece of carving it was, the light colour like box-wood, and the sharply defined edges contributing to mislead those who had never heard or dreamed of Pine-tree cones larger than a man's head. The cone of *P. Sabiniana* is, on the other hand, easily opened, the scales separating of their own accord. The seeds of the two species are the converse of what one would expect, the species with the smaller cone (*P. Sabiniana*) having the largest seed. The cone takes about twenty months to come to maturity. In 1852 a tree in the Jardin des Plantes at Paris produced two cones in its eighteenth year. They grew at the top of the leading shoot, one dropped off, but the other remained, and at the end of the first season it measured about 3 inches in length, and $\frac{3}{4}$ of an inch in diameter. At the end of the second season it had reached its full development, and was about 16 inches in length, by about 9 in diameter. We have not heard of cones being produced in Britain; but a tree in the Royal Horticultural Society's Garden at Chiswick bore male catkins, from which the drawings of the male flower above given have been taken.

Geographical Description.—It is found growing in company with *P. Lambertiana* on the mountains of Santa Lucia, near the Mission of San Antonio, in lat. 36° north, within sight of the sea, and at an elevation of from 3000 to 4000 feet above its level. This seems the northern limit of its range: how far, or whether it extends much farther south is not known. To the north of this district it is represented by *P. Sabiniana*.

History.—It was first found by Dr. Coulter (after whom it was named by Don), in the district above mentioned, and its range has not been traced much farther since his time.

Dr.

PINUS COULTERI

3

Dr. Thomas Coulter was born in Ireland, and received a medical education, in the course of which he passed two years at Geneva as a pupil of the elder De Candolle. It was the wont of that distinguished Professor to encourage or require his pupils to write a thesis upon any particular family they might select, and if deserving, he published the thesis in the *Memoirs of the Geneva Society of Physics and Natural History*, or in the "Transactions" of some other scientific society. Coulter selected the family of *Dipsacæ*, and his thesis, which is an excellent one, was published in the *Memoirs of the Geneva Society* just mentioned (vol. ii. p. 11, 1826). After taking his degree as Doctor of Medicine, he went to Mexico on a scientific expedition. Remembering his ties to Geneva, he sent to its Botanic Garden a great many new species of plants, more particularly of Cactus, of which a list was published in De Candolle's review of that family. Humboldt, Bonpland, and Kunth named a new genus of the family of *Leguminosæ* after him (*Coulteria*). After leaving Mexico, he passed to California, at a time when the rattlesnake was still undisturbed by the hordes of gold-seekers who have since turned much of that country into vulgar ground. He there discovered many new trees and plants, among which may be specially mentioned *Abies bracteata* and the present species.

Properties and Uses.—Not much is yet known of the quality of the timber of this tree. There is to be seen in the Royal Horticultural Society's Garden at South Kensington a section of a tree upwards of a foot in diameter, grown at Mr. Hope's property, the Deepdene, in Surrey. The annual rings in this specimen are large, and are interrupted by wide lacunæ or sinuses of a hard resinous matter.

Culture.—It springs easily and strongly from the seed, but is apt to suffer when young from the winter's frost, especially in the North of England. When fairly started, it seems to make fair progress. The tree of which a section is above spoken of shews what it will do in Surrey. There is another specimen at Nettlecombe, in Somersetshire, 21 feet high; at Blenheim Park, in Oxfordshire, 30 feet high; one of the same height at Castle Ashby, in Northamptonshire; and one at Dropmore, 32 feet high. There is a fine specimen at Kew, which was unhurt by the winter of 1879–80 and 1880–1881.

Commercial Statistics.—Price in 1850, seedlings, small, in pots, 21s. each; grafted, 17s. 6d. each; in 1863, 3 to 4 feet, 7s. 6d. each; in 1873, 1 to 2 feet, 3s.; 2 to 3 feet, 3s. 6d. to 4s. each; in 1883, 12 to 15 inches, 2s. 6d.; 2 to 3 feet, 5s. each.



PINUS EXCELSA, WALL.

PINUS EXCELSA.

IDENTIFICATION.—PINUS STROBUS, Hamilton's *Account of Nepaul*, p. 83 (1802).

PINUS CHYLLA, *Loddig. Cat.*, p. 50 (1836).

PINUS EXCELSA (*Wallich MSS.*); Lambert, *Genus Pinus*, ed. 2, i. p. 55 (1828); *Wallich List*, No. 6059 (1828); Wallich, *Plant. Asiat. Rarior.*, iii. p. 1 (1832); Loudon, *Arboretum*, iv. p. 2285 (1838); Forbes, *Pinet. Woburn.*, p. 75 (1839); Loudon, *Encycl. of Trees*, p. 1022 (1842); Link, in *Linnaea*, xv. p. 515 (1841); Spach, *Hist. Nat. Vég. Phaner.*, xi. p. 396 (1842); Antoine, *Conif.*, p. 42 (1846); Hoffmeister, in *Bot. Zeit.*, p. 184 (1846); Endlicher, *Syn. Conif.*, p. 145 (1847); Knight, *Syn. Conif.*, p. 34 (1850); Lindley and Gordon, in *Journ. Hort. Soc.*, v. p. 215 (1850); Madden on Himalayan Conifers, in *Journ. Agric. and Hort. Soc. of India*, vii. p. 75, and reprinted in *Journ. Hort. Soc.*, v. p. 228 (1850); Lawson, *Abietinae*, p. 25 (1851); Carrière, *Traité Gén. des Conif.*, p. 300 (1855); Gordon, *Pinetum*, p. 222 (1858), and *Supplement*, p. 68 (1862); Ørsted, *Frilands-Trævæxten i Danmark*, p. 80 (1864); Henkell and Hochstetter, *Synops. d. Nadelholzer*, p. 90 (1865).

PINUS PENDULA and ABIES PENDULA, Griffith, *Journal of Travels* (posthumously published), pp. 211, 237, 239, 264, 265, 287, 293 (1847), and in *Journal of Asiatic Society*, pp. 217, 218 (1839).

PINUS NEPALENSIS, De Chambray, *Traité Prat. Arb. Rés. Conif.*, p. 312 (1845).

ENGRAVINGS.—*Cones, Leaves, &c.*—Lambert (*op. cit.*), t. 33; Wallich, *Plant. Asiat. Rarior.* (*loc. cit.*), t. 201; Forbes (*op. cit.*), t. 29; Loudon, *Arboretum* (*loc. cit.*), figs. 2197-2202; Loudon, *Encycl. of Trees* (*loc. cit.*), figs. 1915-1918; Antoine, *Conif.* (*op. cit.*), t. 20, fig. 1.

Specific Character.—Pinus foliis quinis, carinato-trigonis elongatis filiformibus, dorso sine stomatibus infra tribus quartis vel quinque seriebus; Strobilis elongatis subcylindraccis conicis pendulis, squamarum apophysi dimidiato pyramidata obtusa convexiuscula adpressa, umbone terminali acuto.

Habitat in omnibus partibus Himalayæ jugi, Sikkim excepto, etiam in Balti, in Thibet, et in Affghanistan.

A lofty pyramidal tree, reaching from 40 to 150 feet in height. The term *excelsa*, however, according to Major Madden, does not apply to the stature of the tree, but to the elevation at which it grows above the sea. Dr Hoffmeister, supposing it to refer to the former, had said that it was "most unworthy of its name, for specimens of more than 40 or 50 feet in height are great rarities;" but Major Madden remarks that even on this head his condemnation is too general. "Large woods no doubt occur in which many of the trees are about this height, but Don mentions 90 to 120 feet as the stature; and between the Shalool Pass and Panwee, as well as below Chansoo in Koonawur, there are magnificent forests containing many trees certainly not under 150 feet." The habit of the tree is straight, its bark greenish or greenish grey when young, leaden coloured when older; smooth when young, more or less rugged when old. Branches verticillate, growing upwards except at the ends, when they sometimes bend downwards; when older the branches droop, whence it is called in India the Weeping Fir. Its growth appears often as if too rapid for its strength. The young branchlets are slender, and verticillate; buds small, conico-cylindrical, and pointed [fig. 1]. Leaves in fives [fig. 2], glaucous green, about 6 inches long, slender, tufty, rather flaccid, dishevelled, and shabby-looking; trigonal, with the margins strongly serrated, without stomata on



Fig. 1.

the back, and with three, four, or five rows on each of the inner sides [figs. 3 and 4]. Sheaths half an inch



Fig. 2.

long, falling off very soon, so that they are only seen on half-developed leaves, and surrounded by long straight membranous imbricated brown scales [fig. 5 natural size, and fig. 6 the same magnified]. It flowers from the end of April to the middle of June, according to exposure, and the cones take eighteen months to mature. Male catkins purple, terminal, and sessile, surrounded by brown imbricated scales, short, obtuse, conic [fig. 7, a cluster of catkins; and fig. 8, a single catkin, magnified]; the anthers bilocular, the crest oval, and with a lacerated margin [fig. 9 front view and fig. 10 side view]. Female catkins, growing three or four together, oblong cylindrical, with a very short peduncle, which afterwards becomes longer. [Fig. 11 shews the young female catkin of its natural size, and fig. 12 the same magnified.] Cones, before impregnation, erect, and violet rose colour; after impregnation, pendent, and with a dull greenish hue spreading over them like a bloom, afterwards pale brown; about 6 inches long, cylindrical, smooth, and slightly curved and pointed at the apex, ripening in September and October of the second year. Scales loosely imbricated, elongate, somewhat wedge-shaped, with the apophysis slightly thickened in the middle, thinned at the edges, obliquely rounded at the margin, very finely longitudinally striated, and with a slightly pointed, short, broad, darker umbo at the apex, constricted at the base [fig.



Fig. 3.



Fig. 4.



Fig. 5.



Fig. 6.

13 back, and fig. 14 front of scale from middle of cone, grown in the Himalayas; and fig. 15 back and fig. 16 front of similar scale from English-grown specimen]. The remains of a bract, usually irregularly broken and defaced, adhere to the back [fig. 17 natural size, and fig. 18 magnified.] The seeds [fig. 19 foreign growth, and fig. 20 English growth] are not very large (about the size of a small pea), ovate, flattened on both sides, black, with some grey spots; wing from three-fourths to an inch in length, oblong obtuse, with the back straight. The cotyledons average about



Fig. 9.



Fig. 10.



Fig. 11.



Fig. 12.

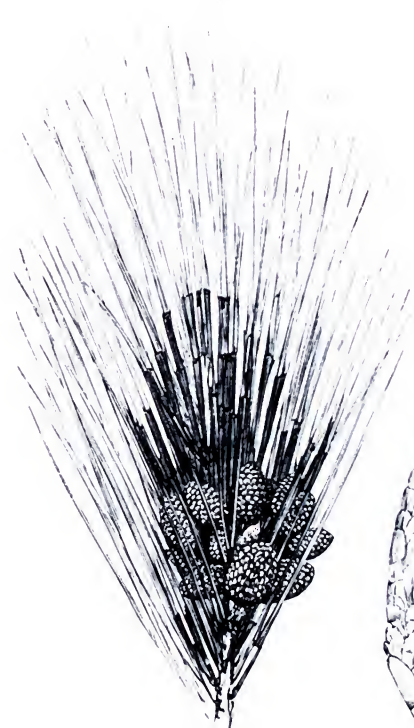


Fig. 7.



Fig. 8.

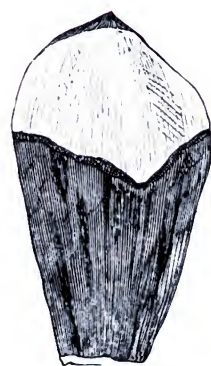


Fig. 13.



Fig. 14.

months afterwards hanging to the branches.

This species is very closely allied in habit and the figure of its cones to *Pinus Strobus* and *P. monticola*. Lambert first pointed out the difference in the crest of the anthers, which is a good specific character. The form of the crest of the anther in *P. Strobus* is represented in figs. 21 and 22, copied from Lambert, which may be contrasted with fig. 10 above and fig. 23, a less characteristic drawing



Fig. 15.



Fig. 16.

copied from Lambert. The greater size of the leaves and the larger cones, and the general habit of the tree, furnish characters which, although not perhaps so easily described, are more easily recognisable.

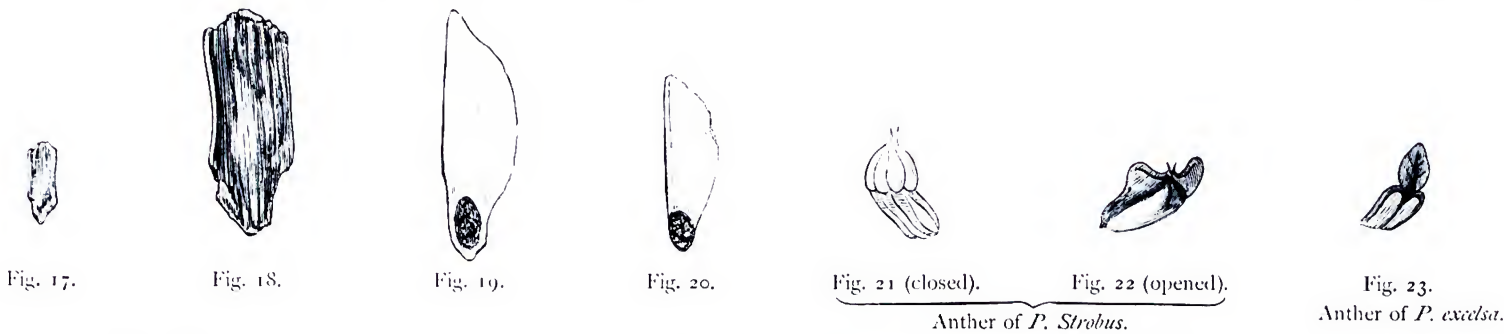
Major Madden notes that on the northern side of the Roopin Pass many specimens may be noticed with bright green leaves, which at other places are mingled with foliage of the glaucous green proper to the tree on the lower mountains.

Dr

PINUS EXCELSA.

3

Dr Griffith speaks of a species which he met with at 9500 feet in company with *Abies morinda*, which was very like *Pinus excelsa*, but differed in having erect leaves. (Griffith's "Itinerary Notes," p. 149.) This



may have been *P. Peuce* or some other unknown *Strobilus*. In Nepaul, too, Dr Wallich observed a variety which appeared to him to come closer to *P. Strobilus* than the usual form. (Royle's "Illustrations.") Information is to be desired about these forms.

Geographical Distribution.—This species is found along the whole of the Himmalayan range, except in Sikkim; also in Balti, Thibet, and in Affghanistan. In the following table we have brought together all the localities which we have found recorded of its occurrence, the greatest part of which we owe to Major Madden's paper above quoted. We begin at the easternmost portion of the Himmalayas, following the range westwards; and noting not only the localities where it is found, but those in the line where it is absent, and where it might at first sight be expected to be met with.

District.	Locality.	Position.	Remarks and Authority.
Abor	None	None	All authors unite in giving Bhotan as the most easterly locality for this Pine.
Bhotan.....	On the range which separates the Mo- mas Valley from Assam	On the northern face of this range	Hooker, "Flora Indica," p. 177.
"	Generally distributed	Common on southern aspects, forming large and beautiful woods, at from 6000 to 10,000 feet next above <i>Pinus</i> <i>longifolia</i> and below <i>Abies morinda</i>	Griffith, "Journals of Travels," 211, 237, 239, 264, 265, 287, 293. W. S. Webb.
Sikkim	None	None	Hooker, "Flora Indica," p. 181.
Eastern Nepaul	None	None	Major Madden gives Dr Hooker as his authority for saying that there are none in Eastern Nepaul; but we do not find this statement in the "Flora Indica."
Western Nepaul	Gossainthan	The highest and largest mountain at this part of the range	Dr Wallich.
"	Sheepoor .....	... ..	Major Madden, "Journ. Hort. Soc."
"	Narainhetty .....	... ..	Dr Francis Hamilton, "Account of Ne- paul," and Buchanan.
"	Bunipa .....	... ..	Probably introduced. Major Madden.
Thibet .....	... ..	North of Nepaul	Dr Hooker, "Flora Indica."
Kumaon, East	Byans	On the Upper Kalee, where Kumaon borders on the Nepaul province of Dottee	Captain Strachey.
" Central	None	None	Do.
" West	None	None	Do.
Gurhwal	Rikholee Goodree	A spur from Trisool.....	Native report, but not observed so far south-east by Europeans.
"	Kunol	Near Ramree	Do.
"	On the descent from Pilgwenta Pass to Josheemuth, between Toongasee and Ning	Below <i>Abies morinda</i> and <i>Picea Pin- drow</i>	Major Madden and Lt. R. Strachey.
"	Mountains on south side of Uluknunda as far down as the Patal Gunga, be- hind Lungsee Ghat .....	... ..	Do.
"	From Lungsee Ghat up the course of the Dhoulee .....	... ..	Dr Jamieson, Lt. R. Strachey, and Mr Commissioner Batten.
"	Ascent of the Nectee Pass	Uppermost and only Pine there met with	Do.

PINETUM BRITANNICUM.

District.	Locality.	Position.	Remarks and Authority.
Gurhwal	Bumpa	Upper limit, 11,800 feet	Dr Jamieson, Lt. R. Strachey, and Mr Commissioner Batten.
"	Kaleekhat	A spur of Toongnath, associated with <i>Abies morinda</i> and below <i>Picea Pindrow</i>	Dr Hoffmeister.
"	Lamakaga Pass, leading from the Ganges to the Buspa	Uppermost Pine, both on north and south face, reaching to 11,500 feet on the former and 8500 on the latter	Do.
"	Harung Pass, behind Sungla	600 feet above <i>Picea Webbiana</i>	Do.
"	Between Jaka and the Roopin Pass ...	Associated with the lowermost specimens of <i>Picea Webbiana</i>	Major Madden.
Busehur .....	... ..	Chiefly below <i>Picea Webbiana</i>	Do.
Simla	Near Simla	7000 and 8,425 feet above the sea	Captain A. Gerard.
"	Mount Jako (highest in the ridge)	On the southern face	Dr Thomson, "Western Himalaya."
"	Muhasoo	Reaches 9000 feet	Major Madden.
"	Kumuloree, behind Nagkunda	9500 to 10,000 feet	Do.
"	Kotkhace	Abounds at 5500 feet, and here only on the shaded side of the mountains	Do.
"	Along the Beeskool stream below Deorah in Joobul, nearly down to the Pubur, opposite Raengurgh	Probably its lowest site; little more than 5000 feet above the sea	Do.
Kunawur.....	Between the Shutool Pass and Panwee	... ..	Do.
"	Below Chansoo.....	... ..	Do.
Kashmir .....	... ..	... ..	Baron Hugel.
Balti.....	... ..	Western Thibet	Dr Hooker, "Flora Indica," p. 195.
Gilgit .....	... ..	Mountains in lat. 35½°	Mr Winterbottom.
Kafiristan	Common on the mountains	North of Jellalabad, and not extending farther west than the 69° of east long.	Dr Griffith, "Itinerary," and Dr Hooker, "Flora Indica," p. 255.
Affghanistan ...	Safed Koh range, which bounds the valley of the Kabul river on the south	On the northern slope of the mountains, which are lofty and snow-clad almost throughout the year	Dr Hooker, "Flora Indica," pp. 195 and 256, and collection at Kew.

One thing strikes us in following the above range of this tree, and that is, that it seems, with only one or two exceptions, to be confined to the southern range or main axis of the Himmalayas. The main range runs through or forms the frontier of Bhotan, Nepaul, Gurhwal, Busehur, Simla, Kunawur, Balti, Gilgit, Kafiristan, and Affghanistan. Sikkim, which is a southern parallel branch of the same range, has no *Pinus excelsa*. Kumaon, however, does not actually form part of it, but is much nearer it than Sikkim, and it has the tree in abundance.

The occurrence of the tree near Jellalabad, in Kafiristan, and on the Safed Koh range, south of the Cabool in Affghanistan, is rightly considered by Dr Hooker a mere continuation of the Himmalayan distribution. The Himmalaya itself goes no farther west than the mountains of Gilgit, but turns southward; and it is on this southward extension of that range that the tree is found in Affghanistan. *Pinus excelsa* is therefore strictly a tree of the main range of the Himmalaya Mountains, a fact not without significance when we remember that, according to geologists, the two ranges of the Himmalayas were elevated at different periods. Its most northern habitat is that in the Gilgit Mountains, in lat. 35½° N., and its most southern in Bhotan, in lat. 27°. Its highest recorded elevation above the sea is 12,140 feet (at least, that is given by Capt. Gerard for the Leem, which is the same tree), and its lowest is 5000 feet, it having been once observed by Dr Griffith (*op. cit.*, p. 239) in Bhotan, in company with *P. longifolia*, as low as 5400 feet.

History.—The first author who drew attention to this species was Dr Francis Hamilton, who gathered it in 1802, near Narainhetty, and noticed it in his "Account of Nepaul" under the name of *Pinus Strobilus*, from which he did not separate it. Dr Wallich next determined its characters, and named it *P. excelsa*. He brought home many good specimens in various states, some of which he placed in the hands of Mr Lambert, who published it as a new species in the second edition of his "Genus Pinus," under

PINUS EXCELSA.

5

under the name given to it by Dr Wallich, and the remainder are still in his collection in the possession of the Linnæan Society. Since then its history is almost confined to the discovery of additional localities and the ascertainment of its geographical range.

Its Bhotiya name is Lumshing, Lamshing, or Lemshing.

Its Nepaulese name is Decoshera, Deoologhosec, or Dhoop (words belonging to the Newarree and Parbuttee languages).

Its name in Kumaon is Ræsula or Ræsulla (meaning King of Firs in the Hindostanee language).

„ Gurhwal „ Cheela, Kuel, Tschir, or Tschil.

„ Busehur „ Cheel.

„ Joobul „ Cheeltoo, Cheetoo, Checso.

„ Simla „ Kyl or Kel, Kael.

„ Kunawur „ Leem.

„ Kashmir „ Kair.

„ Kafirstan „ Piunec.

It was introduced into Britain by Dr Wallich about 1827. Lambert says, “I have been fortunate in raising many young plants of this fine species, which, however, are still so small that I have not yet ventured to put them out in the open ground; but I have little doubt, considering the great elevation at which it is found, but that it will prove equally hardy with the Weymouth Pine.” His expectation has been quite borne out, the tree having proved perfectly hardy, and it is now generally distributed throughout Britain.

Properties and Uses.—The wood is very soft, and consequently in its native country is only used for building and other economic purposes where better kinds of Pine timber are not procurable. In Bhotan, however, it is said by Capt. W. S. Webb to be preferred to every other timber which grows there, but neither the Deodar nor the *Pinus longifolia* are found in Bhotan. In the Western Himalayas it is placed next after the Deodar and the Cheer (*P. longifolia*) for usefulness. It is very resinous. Capt. Webb says, in a letter quoted by Lambert, that it yields in great quantities a pure and liquid turpentine by the slightest incision. The cone has generally also some resinous drops adhering to the tip of the scales; but Capt. Webb's remark doubtless applies to the timber, which is, like that of the other Weymouth Pines, white, soft, and easily worked. It is said to be much esteemed in Busehur as fuel for smelting iron. In Kashmir Baron Hugel says it is preferred for burning lime.

Major Madden, on the authority of Capt. H. Strachey, says that chips of *Pinus (excelsa?)* are imported from Poldar to Zanskar of Ludakh, where they are used for candles, and called *Lashi* or *chan-shing*, i.e., night wood; and that in Nepaul knots of this, or *P. longifolia*, are cut into slips for torches, called *Diyaloo*.

Culture.—As already said, the tree is perfectly hardy in this country. It also thrives in France, Germany, Belgium, &c. Professor Örsted includes it among the hardy pines in Copenhagen, but Mr Schubeler does not mention it as one of the forest trees cultivated in Norway and Sweden.

Mr Palmer's tables, of the worst effects of the cold in this country in 1860, give, out of 95, only five places where it proved fatal. His abstract is as follows:—

	Killed.	Much Injured.	Slightly Injured.	Not Injured.	Total.
England	3	...	3	65	71
Scotland	2	2	1	15	20
Ireland .....	...	...	...	4	4
	5	2	4	84	95

6

PINETUM BRITANNICUM.

Those that were killed were at Appleby Hall, in Lincolnshire (lowest temperature -11°); at Thorpe Perrow, in Yorkshire (lowest temperature -12°); and Brough Hall, in Yorkshire (lowest temperature not stated). At Lanrick Castle, in Perthshire (lowest temperature 3° , marked as probably having died from other causes); and at Newton, in Aberdeenshire (lowest temperature -8°): places where the cold had been excessive, judging from the temperatures above given.

The following are the heights of some of the best specimens in England, most of them taken in 1862 or 1863. The age, where known, is added. We have included none under 30 feet in height:—

Place.	County.	Height in Feet.	Supposed Age.	Place.	County.	Height in Feet.	Supposed Age.
Bloxholme Hall ...	Lincolnshire	50	25	Cuerdon Hall	Lancashire	34	26
Woburn Abbey ...	Bedfordshire	47	35	Studley Royal	Yorkshire	33	25
Bicton	Devonshire	50	30	Highnam Court ...	Gloucestershire.....	32½	23
Eggesford	Devonshire	40	30	Longwood	Hampshire	31	18
Patterdale Hall ...	Westmoreland	40	22	Cardew	Cornwall	30	14
Redleaf	Kent	35	20	Wimbledon	Surrey	30	30
Bownnoe	Cornwall	35	20	Windsor Castle.....	Berkshire	30	26
Ambleside.....	Westmoreland	35	25	Calderstone	Lancashire	30	35

The highest which we have a note of from Scotland is at Rossdhu, in Dumbartonshire, 26 feet high, and 18 years old. In Ireland there is one at the Earl of Shannon's, Castle Martyr, near Cork, 26 feet high and 15 years old; and another of the same size, but 20 years old, at Caledon Hill, in Tyrone.

It suffers from rabbits in its youth, when they are apt to bark it, but when older they do not meddle with it. We have met with only one instance of its being attacked by the pine beetle, *Hylurgus piniperda*, but it was got rid of by the usual sacrifices and precautions. It does not stand the wind well, at least in its younger state. Its growth is rapid, and appears to be faster than that either of the Scots Fir or the Weymouth Pine.

Commercial Statistics.—In 1851, 1 and 2 year seedlings sold respectively at 20s. and 30s. per 100; plants 1 foot high, 9s. per dozen; and 18 to 24 inches, 3s. 6d. each. In 1855, 1 and 2 year-old seedlings sold at 35s. and 75s. per 100; plants, 18 to 24 inches, 2s. 6d. to 3s. 6d. each; and fine specimens, 8 and 9 feet, at 63s. to 84s. In 1860, 1-year seedlings, 5s. per 100; plants, 9 to 12 inches, 50s. per 100. In 1867, seedlings, 6 to 12 inches, 6s.; and 18 to 24 inches, 12s. per dozen; good specimens, 6 to 10 feet high, 10s. 6d. to 21s. each. The price of clean seed, in 1861, was 12s. per oz., and, in 1867, 7s. 6d. per oz.

PINUS FLEXILIS

IDENTIFICATION.—PINUS FLEXILIS. James in *Long's Exped.*, ii. pp. 27, 34 (1823); Nuttall, *Contin. of Michaux's Sylva*, iii. p. 107, pl. 112 (1840); Torrey in *Ann. Lyc. N.Y.*, ii. p. 249; Engelmann in *Wislizenus' Tour in Northern Mexico in 1846-47*, p. 89 (1848); and in *Trans. Acad. Sc. of St. Louis*, ii. p. 208 (1863); Parlatore in *D. C. Prod.*, xvi. 2, p. 403 (1868); A. Murray in *Gard. Chron.*, p. 356, fig. 75 (1875); Engelmann in *Trans. Acad. Sc. of St. Louis*, iv. p. 175 (1880); in *Revision of Genus Pinus*, p. 15 (1880); and in *Botany of California*, ii. p. 124 (1880).

ENGRAVINGS.—Nuttall, *Contin. of Michaux's Sylva*, loc. cit., pl. 112 (1840); A. Murray in *Gard. Chron.*, 1875, p. 356, fig. 75.

Specific Character.—Arbor mediocris seu elatior; foliis dense confertis quinque subbiuncialibus rigidis integris acutiusculis ex axillis perularum lanceolatarum deciduarum, squamis vaginantibus obtusis laxis mox evanidis; amentis masculis ovatis involucre sub-8-phyllo munitis in axillis bractee lanceolatae patulae deciduae sessilibus antherarum crista minore irregulariter inciso-dentata; amentis femineis subverticillatis in pedunculo brevi perulis late lanceolatis acutis dense stipato erectis squarrosis; strobilis ovato-cylindricis squarrosis horizontalibus seu declinatis e rubello fuscis, squamis e basi breviter cuneata latissimis orbiculato-rhombeis, apophysi convexa semicirculari incrassata margine area parva subrhombea inermi notata; seminibus, magnis obovatis exalatis carinatis.

Habitat in Montibus rupestribus.

Description.—A middle-sized tree, usually 30 to 50 feet high. In Colorado it is a fine tree, with tapering trunk and oval outline, branching almost from the base, lower branches horizontal, upper ones ascending; wood white, hard, annual rings from $\frac{1}{8}$ to $\frac{1}{2}$ line, on an average $\frac{1}{4}$ line wide; trees become about 1 foot thick in two hundred and fifty to three hundred years. Leaves crowded towards the end of the very flexible branches, persistent five or six years, usually $1\frac{1}{2}$ to $2\frac{1}{2}$, very rarely 1 or 3 inches long; sheaths similar to those of *P. Strobus* or *P. Cembra*, 8 lines long, deciduous. The section of the leaf (fig. 1) is more or less three-sided, with hypoderm, which also surrounds the peripheral resin canals. Male aments 4 to 5 lines long, forming a thick spike 10 to 12 lines long; cones subcylindric, tapering to the end, 4 to 5 inches long, 2 inches in the largest diameter, on short peduncles; scales 12 to 14 lines long, 10 to 12 lines wide, squarrose; lowest sterile ones recurved; fertile ones with deep impressions for the reception of the seeds both on the upper inner side and on the back, the latter cavities partly formed by the large (4 to 6 lines long) ligneous or rather corky bract. Seeds 4 to 5, rarely 6 lines long, irregularly ovate or obovate; wing minute, not deciduous nor adhering to the scale, as in *Pinus Cembra*, *P. edulis*, &c., but reduced to a persistent keel on the upper end and outer edge of the seed; embryo with eight or rarely nine cotyledons.

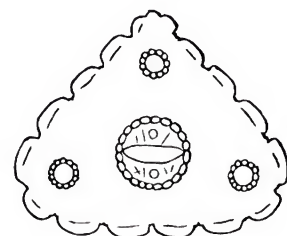


Fig. 1.

Geographical

PINUS FLEXILIS

Geographical Distribution.—This species occurs on the Rocky Mountains, from New Mexico to the 49th parallel, according to Parry, occupying the subalpine belt, never forming entire forests: in the lower elevation associated with *Pinus contorta*, approaching the Alpine districts, scattering with *P. aristata*.

Dr. Engelmann gives the following habitats with their authority: Fendler (n. 832) collected it in the mountains above Santa Fé in 1847, and Dr. Bigelow found it in the neighbouring Sandia Mountains, New Mexico, at an elevation of about 12,000 feet above the level of the sea. James, Parry, Hall, and Harbour are authorities for its presence in Colorado, H. Engelmann for it on the Laramie Mountains and on the headwaters of the Platte, Nuttall on the mountains from the Platte to the Bear River, Fremont on the Wind River Mountains, and Dr. Hayden on the Big Horn Mountains and mountains at the headquarters of the Snake River and of the Yellowstone, Missouri, and Columbia Rivers.

Dr. Engelmann mentions that where Mr. Fendler found it on the mountains of Santa Fé, it reached a height of 60 to 80 feet; and notwithstanding this great size, he accepts the determination as correct, on the ground of Fendler being "a good authority."

Dr. Bigelow (Pacif. Railroad Reports, vol. iv., Whipple's Expedition, Botanical Report, p. 20), speaking of the specimens met with at the Sandia Mountains, says, "In its cones and habit it is closely allied to *Pinus Strobus*, which is the White or Weymouth Pine of the north and east. On the authority of Dr. James, who first discovered this species, it is asserted that the seeds are large and edible." One would imagine from this that Dr. Bigelow had not himself seen the cones, for if he had, he would not require to refer to another authority. As the period of the year when he was at the Sandia Mountains was in October, the cones must at that time have been in perfection, according to the itinerary of Lieutenant Whipple's Expedition which remained at Albuquerque (which lies in or at the base of the Sandia Mountains) from the 17th October to the 6th of November 1853. Dr. Bigelow further mentions that "at an elevation of the San Francisco Mountains nearly equal to that of the Sandia Mountains, it was found again, forming a large and beautiful tree 100 to 130 feet in height." This would be about 2nd or 3rd January 1854.

Dr. Engelmann (*Trans. Acad. Sc. St. Louis*, ii. p. 208) is of opinion that the trees seen by Dr. Bigelow on San Francisco Mountains must belong to some other five-leaved species. In the meantime, at all events, it will be safe to regard that point with doubt. He quotes Lyall as finding it on the British boundary line, in the Rocky Mountains; but for the reasons we have given under its ally, *P. albicaulis*, we rather refer what Lyall met with to that species. As we have explained under the head of *Abies Douglasii*, there seems to be a gap in the continuity of the productions of the Rocky Mountains to the north of Pike's Peak.

History.—The first notice of this species is by Dr. James in Long's Expedition (1823). He says, that, like *Pinus Strobus*, the leaves are five in a sheath, but that beyond this there is little resemblance to it. "The leaves are short and rigid, the sheaths short and lacerated, the strobiles erect, composed of large unarmed scales, being somewhat smaller than those of *P. rigida*, but similar in shape and exuding a great quantity of resin."

Nuttall next figured it in his continuation of Michaux's "Sylva," pl. 112, Engelmann (*Trans. St. Louis Acad., supra cit.*) says of it, "Nuttall's figure in his 'Sylva,' pl. 112, is very poor, and even quite incorrect; nor can I learn that any specimen of his is preserved in the herbarium of Mr. Durand or of the Academy of Natural Science in Philadelphia, but suppose that he had our species in view."

Engelmann is the next authority, who speaks of it in Wislizenus' "Tour in Northern Mexico in 1846-47," where he says, "A third species, *Pinus flexilis* (James), was overlooked by Dr. Wislizenus, but has been collected in five specimens by Mr. Fendler about Santa Fé (in 1847). Its leaves in fives, and pendulous cylindrical squarrose cones, assimilate it to *P. Strobus*, but the seed is large and edible, as Dr. James has already remarked, and the leaves are not serrulate and much stouter" (p. 89).

The

PINUS FLEXILIS

3

The Pacific Railroad Explorations followed.

The last original observations are those of Dr. Engelmann in the paper already referred to in the *Transactions of the St. Louis Academy of Science*. We have taken the description given by that botanist as our authority for the species; for James' description and Torrey's diagnosis in the *Annals of the New York Lyceum* (vol. ii. p. 249), are based on notes only, no specimens having been collected. This fact may account for some of the discrepancies of foregoing describers.

James, it will be seen, describes the cone as growing erect, Nuttall, in direct opposition, figures it pendent, and Engelmann (in Wislizenus' "Tour") says they are pendent, and in the description which we have above quoted, says they are horizontal or declinate. The truth may perhaps be that they are at first erect, and afterwards pendent. Engelmann, in his latest paper (Suppl. to Parry's Collections in Rocky Mountains), says, "Dr. Parry notes that the cones grow several together, semi-pendulous at the extremity of the horizontal branchlets."

Properties and Uses.—The only use to which this tree has yet been put is to feed Indians with the seeds. James first recorded this. Engelmann mentions it in Wislizenus' "Tour," and in speaking of Parry's collections, he says, "The large seeds of *P. flexilis* are, as Dr. James already stated, and as Dr. Hayden confirmed, eaten by the Indians. They are distinguished from those of any other of our Pines by a persistent sharp-keeled margin representing the wing" (*loc. cit.*)

Culture.—We do not know of any plants of this species having yet been introduced into this country; but from the height at which they are found on the Rocky Mountains, there is little doubt that it will prove hardy when introduced.



W. Richardson del et lith

Day & Son (Limited) lith London

PINUS INSIGNIS.
MENDEOCINO CALIFORNIA.

PINUS INSIGNIS.

IDENTIFICATION.—PINUS INSIGNIS (Douglas), Loudon, *Arboretum*, iv. p. 2265 (1838); Loudon, *Encycl. of Trees*, p. 988 (1842); Forbes, *Pinct. Woburn.*, p. 51 (1839); Spach, *Hist. Nat. Vég. Phaner.*, xi. p. 389 (1842); Bentham, in *Voyage of the Sulphur*, p. 55 (1844); Antoine, *Conif.*, p. 27 (1846); Endlicher, *Syn. Conif.*, p. 163 (1847); Lindley and Gordon, in *Journ. Hort. Soc.*, v. p. 217 (1850); Knight, *Syn. Conif.*, p. 30 (1850); Lawfon, *Abietineæ*, p. 31 (1851); Carrière, *Traité Gén. des Conif.*, p. 839 (1855); Torrey, in *U. S. Pacific Railroad Explorations* (Report on General Botanical Collections), iv. p. 141 (1856); Bigelow, in do., p. 25 (1856); Gordon, *Pinctum*, p. 197 (1858); Murray, in *Edin. New Phil. Jour.*, April 1860.

PINUS RADIATA, Don, in *Linn. Trans.*, xvii. p. 442 (1837); Lambert, *Genus Pinus*, iii. p. 133 (1837); Loudon, *Arboretum*, iv. p. 2270 (1838); Loudon, *Encycl. of Trees*, p. 990 (1842); Antoine, *Conif.*, p. 33 (1840-46); Endlicher, *Syn. Conif.*, p. 161 (1847); Hartweg, in *Journ. Hort. Soc.*, iii. p. 226 (1848); Gordon, in do., iv. p. 214 (1849); Lindley and Gordon, in do., v. p. 216 (1850); *Flore des Serres*, vi. p. 434 (1850); Knight, *Syn. Conif.*, p. 30 (1850); Lawfon, *Abietineæ*, p. 33 (1851); Carrière, *Traité Gén. des Conif.*, p. 338 (1855); Gordon, *Pinctum*, p. 206 (1858).

ENGRAVINGS.—*Cones, Leaves, &c.*—VAR. INSIGNIS, Loudon, *Arboretum*, figs. 2171, 2172; Loudon, *Encycl. of Trees*, figs. 1847, 1848; Forbes, *Pinct. Woburn.*, t. 18; Antoine, *Conif.*, t. 8, fig. 1.

VAR. RADIATA, Lambert, *Genus Pinus*, iii. t. 56; Loudon, *Arboretum*, fig. 2182; Loudon, *Encycl. of Trees*, t. 1851; Antoine (*loc. cit.*), t. 14, fig. 3; Gordon, *Journ. Hort. Soc.*, iv. p. 214; *Flore des Serres*, vi. p. 434.

Specific Character.—Pinus foliis ternis quaternifve elongatis filiformibus ferrulatis læte gramineo-viridibus, vagina brevi, strobilis inequilatere ovatis squamarum apophysi elevato pyramidata carina transversa acuta, umbone parvo obtuso medio dente parvo terminato, feminibus parvis concoloribus, ala elongata.

Habitat in California prope Monterey.

A tree of moderate height, in youth thickly clothed with beautiful rich grass-green foliage, with numerous branches, in age more bare of foliage, and knotted and bent. Bark light-brown; leaves [fig. 1] in threes (occasionally four in the sheath), triquetral, slender, filiform, twisted, from 4 to 6 inches long, with from 7 to 9 rows of stomata on the back [fig. 2], and two or three rows on each of the



Fig. 2.



Fig. 3.



Fig. 4.

inner sides, the margins and keel very closely ferrate [fig. 3]. Sheaths not long, about one-third of an inch in length. Buds [fig. 4] from one-eighth to a quarter of an inch long, narrow, cylindrical, rather abruptly pointed. Male flowers in small short catkins, at first clustered together, but as the branchlet (near the apex of which they are produced) elongates, becoming more separated from each other [fig. 5]; fawn-coloured, with a tinge of brownish purple or carmine towards the apex. Anthers [figs. 6, 7, and 8] bilocular, short, the crest with a lacinated margin, septum broad. Cones sub-conical, growing in clusters of two or



Fig. 1.

three together close to the stem or branch, with the apex downward, and turned toward the stem, the outer side with the scales largely developed, stout, and projecting prominently outwards, and extending on that side considerably behind the stalk; from 3½ to 6 inches in length, and about two-thirds of their length at their

broadest diameter; very hard, slightly shining, pale fawn colour. Scales disposed spirally, in five rows the one



Fig. 5.

way, and eight rows the other,* those on the outside nearest the base with their apophyses bent backwards, and the rest on that side with it gradually turning forwards as they approach the apex; the side of the apophysis next the apex strongly convex in them all, that toward the base less so, and slightly biconcave. The scales on the inner side of the cone only slightly convex, or very nearly flat; a narrow doubly-curved transverse thin line or keel runs across the widest part of the apophysis, and in its centre there is a small dark-brown slightly raised umbo, which has a small tooth turned towards the base, but this is often rubbed or broken off. Another narrow raised line runs straight down from this umbo, and a less evident one runs upwards.



Fig. 6.



Fig. 7.



Fig. 8.

Fig. 9 represents a young fresh cone of last year's growth from Ireland, and which is very like that given of *P. insignis* by Lambert

in his "Genus Pinus;" and fig. 10 is a copy of Gordon's figure of *P. radiata*, in the "Hort. Society's Journal." Fig. 11 represents the outside of an individual scale. Fig. 12 gives a lateral view of the same scale. The seeds are rather small, dark brown, not speckled, the wing comparatively long, but varying in length. Fig. 13 is a copy of the figure of the seed and wing, given by Loudon; and fig. 14 is that of *P. radiata*, copied from Gordon's account of it in the "Hort. Society's Journal."

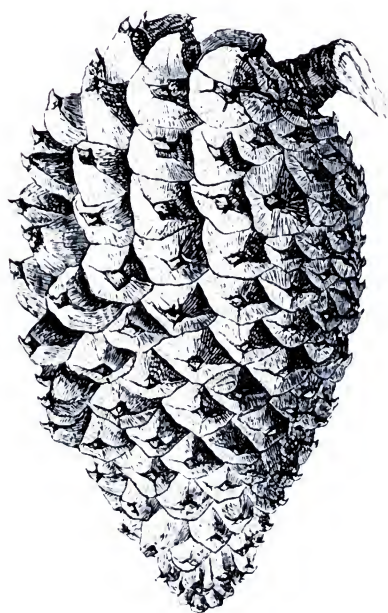


Fig. 9.

In the synonyms at the head of this description, we have united the names of *P. radiata* and *P. insignis*, these, we are well assured, being one and the same; but we have retained the name *insignis* in preference to that of *radiata*, although the latter had the advantage of a slight priority in publication, because the former was applied to the more usual character of the species, the latter to a more developed and less frequent stage of the growth.

The sole difference between the

two is, that the cone of *radiata* is larger, and the scales on its gibbous side more developed, and the size of the seeds contained in it correspondingly greater. Mr Gordon further gives, as a distinguishing character, that in the wild specimens, although the cones of *radiata* are larger, the

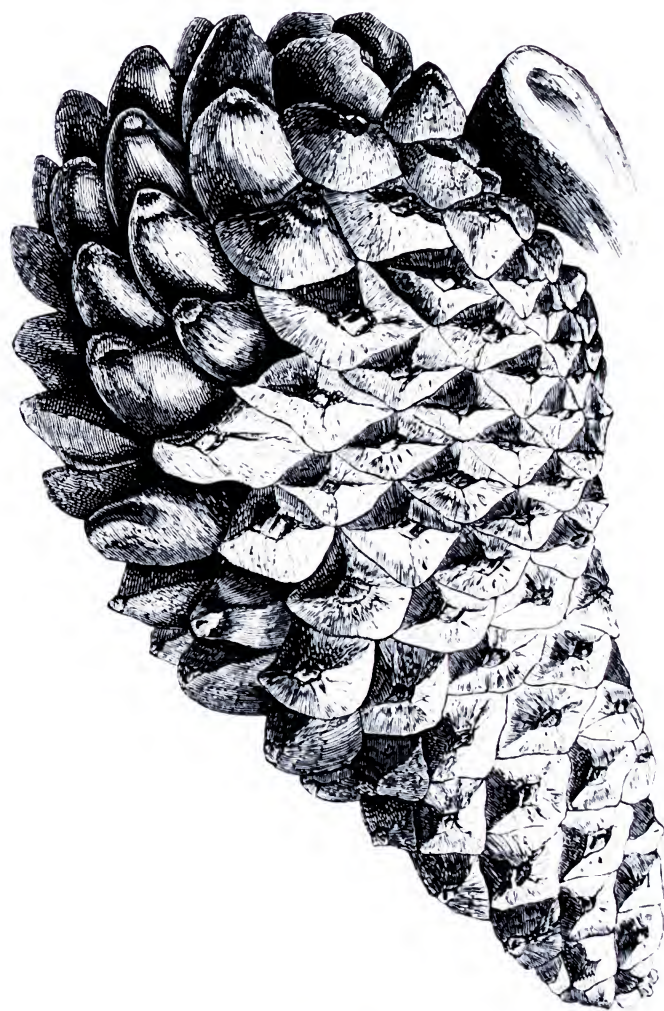


Fig. 10.

* Gordon says ("Journ. Hort. Soc.," iv. 216) that each cone contains from fourteen to sixteen rows of scales. This is a mistake. It has only the usual number, viz., five rows in one spiral, and eight in the other. We know of no cone which has more than this number, although some, as the Larches and Hemlock Spruces, have only five rows either way.

PINUS INSIGNIS.

3

leaves are smaller. So far as the specimens grown in this country are yet able to speak, this difference does not hold true; if anything, it is the leaves of *P. insignis* which are smallest; those grown



Fig. 11.



Fig. 12.

here being about half an inch smaller than the dimensions given of those of *P. radiata*; but this is a character of no value, for it is easy to find on every tree leaves varying in length to a greater extent than that specified by Mr Gordon. We are not aware of any plant having produced fruit of the latter form in Britain, although there have been specimens



Fig. 13.



Fig. 14.

produced of the former, so that we have not the means of comparing home-grown cones; but we know that the very similar species, *P. tuberculata*, is exceedingly variable in the size and form of its cones; that *P. Benthamiana* is so also; and that the Mexican species of this type are equally variable. We, therefore, do not think that a plant which has nothing to distinguish it but the cone being a third larger than the type, can fairly be regarded as a distinct species.

It is to be observed that Hartweg himself, when he discovered it, did not so regard it. In the Journal of his Expedition (published in the "Journal of the Horticultural Society," vol. viii. p. 226), he says, "I returned to San Antonio, and crossed by the farm of El Piojo, where the ridge is less elevated. A small Pine wood, which became visible on our descent, extending along the beach, looked like an oasis in the desert, the dark green of the Pines forming a beautiful contrast with the parched-up fields. Upon a nearer examination, I found the wood to be composed of a variety of *Pinus insignis*, with larger cones than those about Monterey, from which it also differs, in their being produced in less abundance."

The figure given by Lambert of the cone of *P. radiata*, in his "Genus Pinus," is not larger than the cone of *P. insignis* usually is, and we should imagine, from his not speaking of two species, that he did not consider that there were two. He had, no doubt, the same materials as Loudon and the authors who followed him. Moreover, in the accounts of the species found by the United States' Pacific Railroad Exploring Expeditions we find no mention of *P. radiata*, but *P. insignis* is mentioned, and of it Dr Torrey remarks, "The cones when fully grown are about six inches long;" in other words, exactly the size of those of the so-called *P. radiata*. "They are usually gibbous, and a little curved; the points of the scales much more developed on the gibbous side."*

The relative size of the cones and leaves, therefore, gives no ground for dividing the species into two.

Dr Coulter found this tree (the variety *radiata*) attaining the height of 100 feet when grown singly, and with a straight stem feathered to the ground with branches; and of the normal type *insignis*, Mr Gordon says that it grows to the height of "from 80 to 100 feet, and from 2 to 4 feet in diameter, feathered to the ground with branches;" but Dr Torrey (*loc. cit.*) says that "the ordinary height of the tree is from 30 to 40 feet." This we shall presently see is considerably less than the height the tree promises to attain in this country; but truly we do not want any more. The beauty of this tree lies in the lovely green of its foliage and its abundance; and that, of course, is all thrown away at a height of 80 or 100 feet. Its beauty is better seen near at hand. It is somewhat wayward, however, and rather declines to follow any prescribed plan of growth, being somewhat irregular in its shape. This is seen in one of the coloured plates, which is a portrait of a young tree at Osborne, taken from a photograph, which we have had the gratification of receiving by command of the Queen. Mr Andrew Toward, the resident manager of the Royal estate at Osborne, informs us that this tree was planted in April 1847, being then about 4 feet high. It is now (1866) 50 feet in height, and the stem, at 3 feet from the ground, 6 feet 6 inches in circumference. In 1849, two years after being planted, it made a growth of 3 feet 9 inches; the following year 5 feet 9 inches; and in 1851, 6 feet 6 inches.

The coloured plate of the old tree is from a large photograph, one taken not far from San Francisco, and

* Torrey's Report in U. S. Pacific Railroad Explorations, 1854, vol. iv.

PINETUM BRITANNICUM.

4

and well illustrates the gnarled appearance which in age is characteristic, not only of this Pine, but of *P. contorta*, and many of the Pine trees of North-West America.

In its early youth, its refreshing green and thick-packed slender leaves make it a beautiful shrub.

Geographical Distribution.—Apparently confined to California. It was found by Coulter in Upper California, in lat 36°, near the level of the sea, and growing almost down to the beach; also in the form both of *P. insignis* and *P. radiata*, in the neighbourhood of Monterey, not far to the south of San Francisco. It was also noticed by Hartweg, as above mentioned, on the descent towards the sea on the mountains of San Antonio, sixty leagues south of Monterey. Lastly, it was found by the United States' Exploring Expedition on the mountains near Oakland; also on the South Yuba, and on the Coast Mountains, California.

History.—First discovered by Dr Coulter, and described as *P. radiata* by Don in the "Linneæan Society's Transactions," and immediately afterwards by Lambert in his "Genus Pinus;" then described both as *P. insignis* and *P. radiata* by Loudon, who has been followed by subsequent European writers. The American authors have not recognised the name *radiata*, but only use *insignis*. As already said, the former ought, properly speaking, to be the name; but the latter is now so universally adopted that we are glad of any excuse for contravening the laws of priority. We have done so on the strength of the form called *insignis* possessing the normal and more usual characters of the species; although the argument, we are afraid, is not very sound. It is very much as if we should say that a man of thirty is a more normal specimen of man than a man of sixty. He perhaps belongs to a more numerous section, but the one is not a whit more normal than the other.

It was introduced into Britain in 1833.

Properties and Uses.—The most important property of this species is, that it thrives well in sandy soil, and exposed to the sea-breeze. That heavy blasts do not disagree with it may be gathered from the fact that at Point Pinos, near Monterey, the trees had become one-sided, from the north winds blowing upon them for a great part of the year.

Of its uses, unquestionably the chiefest is to please the eye and beautify the scenery of our lawns and country residences. Don states (doubtless, upon Coulter's authority) that it "affords excellent timber, which is very tough, and admirably adapted for building boats, for which purpose it is much used." More information is required upon this point. We have heard it stated that it is utterly worthless, not even being fit for firewood. Mr William Murray mentions* that "the street planking in San Francisco used to be done with Oregon lumber, but now (1855) it is being superseded by the Monterey lumber (most likely *P. insignis*), for the reason that it is very resinous, and stands the wear and tear of such a purpose better;" a quality which we should have imagined would increase instead of diminish its fitness for burning.

It is to be observed, however, that *P. macrocarpa* (*Sabiniana*) and *Coulteri* are also found in plenty in the neighbourhood of Monterey; and we know, from the timber of trees of these species which have been cut down in this country, that they are excessively resinous, resin being extravasated in quantities throughout the timber. It may, therefore, be of them that the resinous Monterey lumber above spoken of consists. At any rate, it is a point to be indicated for future inquiries by those who have the opportunity.

Mr Rogers of Penrose says that if the quality of its timber in this country can be judged of at so early an age, it is light and tough, and the knots are easily worked, are soft yet firm; having the softness of Lime-wood rather than the fibrous rend of the Fir. At this age it is full of eyes, as Bird's-eye Maple is.

Cultivation.—Its native habitat, "on the shores of the sea," almost close to the beach, indicates a sandy soil,

* "Edin. New Phil. Journal," New Series, April 1860.

PINUS INSIGNIS.

5

foil, a marine neighbourhood, and a moist atmosphere, as some of the points to be attended to in cultivating this species to the greatest advantage. Its success in the Isle of Wight justifies this *a priori* conclusion. When it was first introduced, it was said that it would prove perfectly hardy in Britain; and, indeed, so it stands recorded still in most works on the subject of Conifers. This, however, is certainly by no means unconditionally true. It has proved tolerably hardy in the south of England and Ireland; but farther to the north, especially in Scotland, its success—we should rather say its survival or existence—is the exception, not the rule.

Mr Palmer made very full inquiries regarding this species, and the result shews the effect of the winter of 1860 upon the trees growing at 109 places, as follows, viz. :—

	Killed.	Much Injured.	Injured.	Not injured.	Total.
England,	62	6	3	16	87
Scotland,	10	3	1	3	17
Ireland, . . . . .	...	...	1	4	5
	72	9	5	23	109

So that, of those places which came within his inquiries, the result appears to be, that in England the tree escaped uninjured in only 1 out of 5 places; in Scotland at 1 out of 6; while in Ireland it escaped at 4 out of 5.

But a more detailed examination of his tables, as well as of the history of the attempts to establish this Pine in Britain, shews that the only places where it can be planted freely and fearlessly are the west and south-west coasts. In the midland and northern counties, and throughout along the east coast, although occasionally a much-injured tree may have recovered, or even a favourably planted specimen or one protected either by nature or art (that is, by nature, by means of situation or snow; or by man, by artificial coverings), may have escaped altogether: that has been the rare exception which proves the rule.

As this is a tree naturally so much desired, it may be useful to our readers to see in more detail the statistics of its hardiness. The following Abstract shews some results arrived at by a critical examination of Mr Palmer's tables :—

Counties in which the places reported on lie.	Number of places where the tree wholly escaped, or was only slightly injured.	Number of places where some were killed or much injured, and some escaped.	Number of places where all were killed or much injured.	TOTAL.	Counties in which the places reported on lie.	Number of places where the tree wholly escaped, or was only slightly injured.	Number of places where some were killed or much injured, and some escaped.	Number of places where all were killed or much injured.	TOTAL.
ENGLAND.					ENGLAND.				
I. SOUTH-WEST COAST.					VI. INLAND COUNTIES.				
Cornwall	1	1	...	2	Surrey, .....	...	4	...	4
Devon	3	2	1 much injured	6	Berks	4	1	1	6
Somerset	1	...	1 killed	2	Oxford .....	...	...	2 killed	2
II. SOUTH COAST.					Buckingham.....	...	1	...	1
Isle of Wight ...	1	...	...	1	Gloucester.....	...	{ 1 (20 escaped out of 2000)	2 killed	3
Hants	1	...	2 killed	3	Hereford .....	...	...	3 nearly all killed	3
Suffex	1	...	...	1	Wilts.....	...	...	1 killed	1
III. SOUTH-EAST COAST.					Bedford .....	...	1	{ 3 some much injured, most killed	4
Kent	2	1	...	3	Northampton ...	...	1	1	2
IV. WEST COAST.					Stafford .....	...	...	3 killed	3
Anglesea	1	...	...	1	Cambridge .....	...	...	2 killed	2
Chester .....	...	...	1 killed	1	Huntingdon .....	...	...	1 killed	1
Lancaster .....	...	1	1	2	Warwick.....	...	...	2 killed	2
Westmoreland ...	...	...	1	1	Leicester .....	...	...	2 killed	2
V. EAST COAST.					Nottingham .....	...	...	5 killed	5
Essex.....	...	...	2 killed	2	Derby .....	...	...	2 killed	2
Suffolk	1	...	3	4	Stafford .....	...	...	2 killed	2
Norfolk.....	...	...	1 killed	1	Denbigh .....	...	...	1 killed	1
Lincoln.....	...	...	2 nearly all killed	2	Salop .....	...	1	...	1
York.....	...	...	{ 8 all killed, 1 much injured	9					
Northumberland	...	...	2	2					

6

PINETUM BRITANNICUM.

Counties in which the places reported on lie.	Number of places where the tree wholly escaped, or was only slightly injured.	Number of places where some were killed or much injured, and some escaped.	Number of places where all were killed or much injured.	TOTAL.	Counties in which the places reported on lie.	Number of places where the tree wholly escaped, or was only slightly injured.	Number of places where some were killed or much injured, and some escaped.	Number of places where all were killed or much injured.	TOTAL.
SCOTLAND.					SCOTLAND.				
Wigtown	1	...	...	1	Moray .....	...	1	1	2
Mid-Lothian ...	...	1	2	3	Caithness .....	...	...	1	1
Linlithgow .....	...	...	1 killed	1	IRELAND.				
Stirling .....	...	...	1 killed	1	Cork	1	...	...	1
Fife .....	...	1 (all killed but those covered with snow).	...	1	Kilkenny	1	1 only slightly injured	...	1
Perth	1		3 killed	6	Limerick	1		...	2
Forfar	1	...	1	2	Dublin	1		...	1
					Cavan	1	...	...	1

It thus appears that the trees in the west, fouth, and fouth-west of England and Ireland have escaped with little injury, while the great majority of trees in the inland counties have been destroyed. Another remarkable feature is that Scotland seems to have suffered less than the inland counties. That may be due to one of two very different causes: either to there having been a greater amount of snow in Scotland, or to the comparative nearness to the sea of all the places reported on having secured a less severe degree of cold. It may be said that, as we have not given the degrees of cold which each place was subjected to, the tables are of little value; but the reader must remember that, during the winter in question, the whole country, England, Scotland, and Ireland, experienced a long continuous tract of severe cold. Mr Palmer, indeed, gives the lowest degree of cold in every instance where it was known; but it is impossible to embody that in an abstract. It will be sufficient to say that, with a few exceptions, the temperature everywhere reached below zero. The exceptions are, of course, in the maritime counties; but there, even, there are only 11 instances, out of the 109 quoted, where the greatest cold was less than 10° above zero, and none less than 1°. The comparative advantage which places exposed to sea-air, and the climate that accompanies it, have over inland districts in the above tables, will appear more clearly if we pick out the places which are within the influence of sea-breezes, and contrast the results at them with the results at those which are not: thus—

PLACES WITHIN THE INFLUENCE OF SEA-BREEZES.					PLACES NOT WITHIN THE INFLUENCE OF SEA-BREEZES.			
Districts.	Not hurt at all.	Some killed or injured, some not.	Killed or much injured.	TOTAL.	Not hurt at all.	Some killed or injured, some not.	Killed or much injured.	TOTAL.
1. South-west coast, as above	3	1	...	4	1	1	3	5
2. South coast, do.	3	...	...	3	...	...	6	6
3. South-east coast, do. ....	...	...	...	...	2	1	...	3
4. West coast	1	...	...	1	...	1	3	4
5. East coast.....	1	...	2	3	...	...	14	14
6. Inland and northern counties.....	...	...	...	...	...	6	33	39
7. Scotland	1	...	...	1	2	4	10	16
8. Ireland.....	2	...	...	2	2	1	...	3
	11	1	2	14	7	14	69	90

These figures give an average of only one in five, as the proportion killed in trees growing within the influence of the sea-breezes; and the very reverse, or almost the same proportion, as the average of those *not* killed in trees growing beyond the influence of the sea-breezes.

Within moderate bounds the amount of altitude above the sea does not seem to affect the tree injuriously. Longleat, in Wiltshire, 460–700 feet above the sea; Watcombe, in Devonshire, 400 feet; Eastnor Castle, in Herefordshire, 520 feet; Emo Park, in Queen's County, 506 feet; and Cecil, in Tyrone, 300 feet above the sea,—are all places where *P. insignis* has escaped the winter of 1860, and is doing well.

Neither the quality of the soil nor the nature of the geological formations on which the trees are grown seem to have much effect upon its constitution. Mr Palmer's tables shew the following proportions of

PINUS INSIGNIS.

7

of those growing under different conditions in these respects, which succumbed to the winter of 1860, viz. :—

SOILS.			GEOLOGICAL FORMATIONS.				
Number of places where killed or much injured.	Number of places where little or not at all injured.	Proportion which escaped.		Number of places where killed or much injured.	Number of places where little or not at all injured	Proportion which escaped.	
Sandy soil.....	2	1	$\frac{1}{2}$	Clay slate.....	2	2	equal.
Light or sandy loam.....	18	4	$\frac{1}{4}$	Carboniferous limestone, ...	...	1	...
Gravelly, slaty, or stony, ...	9	4	$\frac{1}{2}$	Limestone.....	4	3	about equal.
Loam,	38	4	$\frac{1}{9}$	Oolite,.....	2	...	...
Wet clay,	4	...	none.	Chalk,.....	7	1	$\frac{1}{7}$
				Ironstone,	1	...	...
				Sandstone.....	4	...	...
				Old Red sandstone.....	...	1	...
				Gritstone,	1	...	...
				Marl,	1	...	...

It appears, from the only data in the above table where the instances are sufficiently numerous to generalise from, that the trees in sandy light loam escaped better than those in heavy loam; but it is only in a very minor degree that we can trust to seeing the effects of the soil exhibited in the hardiness of the tree; and the above result is the less to be looked at, seeing the number of other causes which might affect its fate, such as the degree of cold each might have been subjected to, the nature of its exposure, the quality of the plant, &c.

Had we been able to give a comparison of the growth of trees of the same age in the different soils in the same district, that would have been interesting; but for that, unfortunately, we have no sufficient materials. We might contrast the growth of a few trees of the same ages in different counties; but as the soil in most instances of which we have notes seems to have been similar, the result must go to climate and situation rather than to soil. Thus three trees, each 21 years of age, and growing in a loamy soil, have attained the following heights: at Osborne, 50 feet; at Redleaf (Kent), 40 feet; and at Glasflough (Monaghan), 43 feet. Two of 30 years of age, and also growing in loam, have attained respectively 46 feet and 65 feet; the former at Eastnor Castle (Herefordshire) and the other at Bickton (Devonshire). A still more remarkable contrast appears to exist between trees of nearly the same age, at Watcombe (Devonshire) and Longleat (Wiltshire), but it is so great that we suspect some error as to the age, and have indicated our doubts by the usual mark in the table in the next page.

The reader knows that Mr Palmer's tables are not to be taken as representing the statistics of a general census of all the trees in the kingdom; or of the results at all places in the kingdom. They are merely of value as the results of an impartial search after information, wherever it could be procured. A good deal of incidental information relating to other points was obtained by him at the same time, and recorded in his remarks on each case. From these we learn that the older a tree was, the better it withstood the cold. The more exposed trees also seem to have escaped fully better than those in low damp grounds; and many trees that were thought at the time to be irretrievably injured, subsequently recovered. Among those that were slain were many fine trees, 20, 30, and 40 feet high. At Highnam Court in Gloucestershire, at Deddlesley Park and Rolleston Hall in Stafford, a tree of 30 feet high was lost at each of these places; while two others were killed in Gloucestershire, one 45 and another 35 feet high. Of those which remain, the tallest which we know of are, one at Bickton in Devonshire, and one at Mount Shannon in Limerick, both, when measured in 1862, being 65 feet high. There is one at Porthquedden, near Truro in Cornwall, which must now be upwards of 60 feet in height, growing about 100 yards from the sea. It was 55 feet in 1860. The tree at Osborne portrayed in our plate is 50 feet high. In 1860, one at Nettlecombe, in Somersetshire, was 48 feet high; another at Castlehill, in Devonshire, was 50 feet. There is a good tree at Mr Blandy's, near Reading, about 30 feet in height. One at Linton Park, in Kent, was then 41 feet high, and 33 feet in the diameter of the spread of the branches; another 29 feet high and 24 feet

8

PINETUM BRITANNICUM.

in spread of branches. At Fenedon Hall, in Northamptonshire, there was one 35 feet high, which was injured, but subsequently recovered. In Scotland there is a tree at Keir, which was 30 feet in height in 1860, and escaped with flight injury.

It would thus appear that it is reaching in this country a height greater, on the average, than its ordinary dimensions in its native country. When fairly started it grows fast. The tree at Nettlecombe, mentioned above, grew 7 feet in 1861 and 1862, and that at Osborne no less than 6½ feet in 1851.

A few instances taken indiscriminately, where both the height and the age are noted, will give a fairer idea of its rate of growth, viz.:—

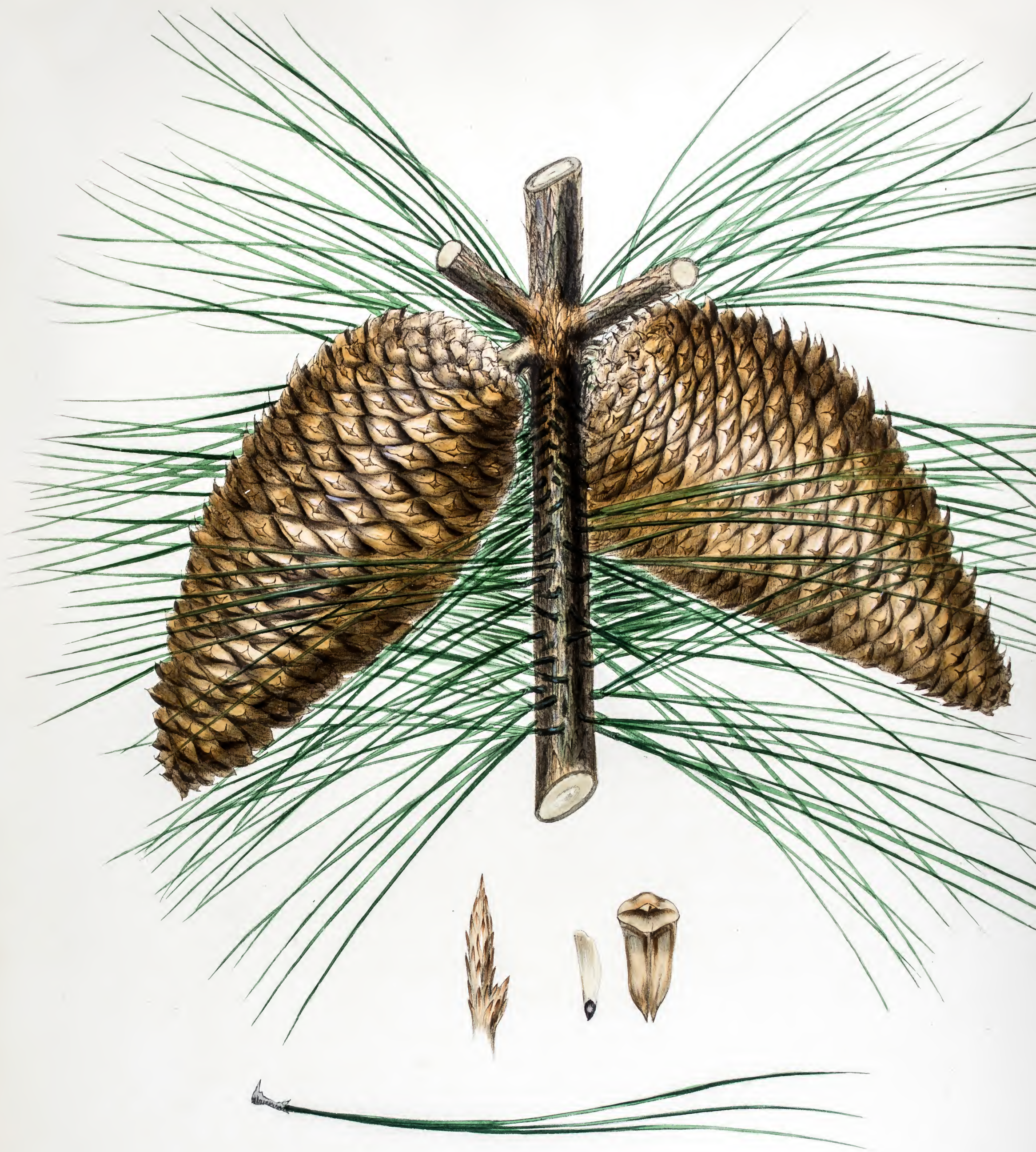
Trees at			Trees at		
	Age.	Height.		Age.	Height.
Osborne, Isle of Wight,	20	50	Watcombe, Devonshire,	12 ?	45
Halfon Hall, Shropshire,	25	24	Penrose, Cornwall,	17	28
Eaflnor Castle, Herefordshire,	30	46	Roffidhu, Dumbartonshire,	18	17
Bicton, Devonshire,	30	65	Mount Shannon, Limerick,	30	65
Madresfield Court, Worcestershire,	3	4	Cecil, Tyrone,	7	13
Longleat, Wiltshire,	11 ?	12	Glaflough, Monaghan,	21	43
Redleaf, Kent,	21	40	Coote Park, Galway,	14	20
Longwood, Hampshire,	24	46	Charlesfort, Meath,	9	22

It seems to thrive in no place so well as Cornwall. Mr Rogers of Penrose, near Helfton in that county, reports of it to the Arboricultural Committee of the Royal Horticultural Society, that it is exceedingly hardy there; resists wind and severe temperatures, having never failed except in the winter of 1860; bears the greatest exposure to which any plantation is subjected much better than any of the usual sheltering Pines, as *P. Austriaca* and *P. Pinaster*. He considers “*P. insignis* to rank far above all other tried varieties as a nurse in exposed sites near the sea in the south of England. It will not thrive in towns; likes pure country air, and prefers Cornwall even to Devonshire. Specimens in the Royal Gardens at Kew scarcely seem the same variety, possessing very little of the fresh vigour of Cornish specimens.” It has one disadvantage for districts which are not so mild as Cornwall, and that is, that the buds push out exceedingly early in spring. Mr Rogers has seen it with young shoots 8 inches in length as early as 31st January (1858). It luxuriates in the moist air of that county, and appears almost to keep growing during the whole year.

Several of the larger trees have already produced cones in this country and in Ireland, such as those at Dropmore, and some places in the vicinity, where it has fruited for several years; at Bicton, at Glaflough, &c. At Porthquedden and Penrose it has for the last nine or ten years produced plenty of cones, from which many beds of seedlings have been raised and planted out; some of the young plants being now upwards of 12 feet high. In France, Carrière mentions that a specimen in the Jardin des Plantes produced cones so long ago as 1852, but the seeds were sterile. The male catkins which we have figured are drawn from a specimen taken from one of the trees flowering at Dropmore in 1865.

It suffers greatly from the Pine beetle, *Hylurgus piniperda*, scarcely a tree of any size in any district escaping from it; but although the *Hylurgus* seems to prefer it to all other trees, this is somewhat compensated by the fact that rabbits only attack it when they have not their greater favourites, *P. Austriaca* or *P. Pinaster*, to feed upon.

Commercial Statistics.—Price of seedlings in 1850, from 12 to 15 inches, 10s. 6d. each. In 1855, 12 inches, 3s. 6d. each; and 7s. 6d., 15 to 18 inches; and well-grown plants 3 to 4 feet, 15s. to 25s. In 1860, 1-year seedlings, 15s. per 100, and plants 15 to 18 inches, 2s. 6d. each. In 1866, seedlings 6 to 12 inches, 1s. 6d. each; seeds, 5s. per 100.



PINUS JEFFREYI, Vred. Conn.

Printed from Zinc, by W & A R Johnston, Edinburgh

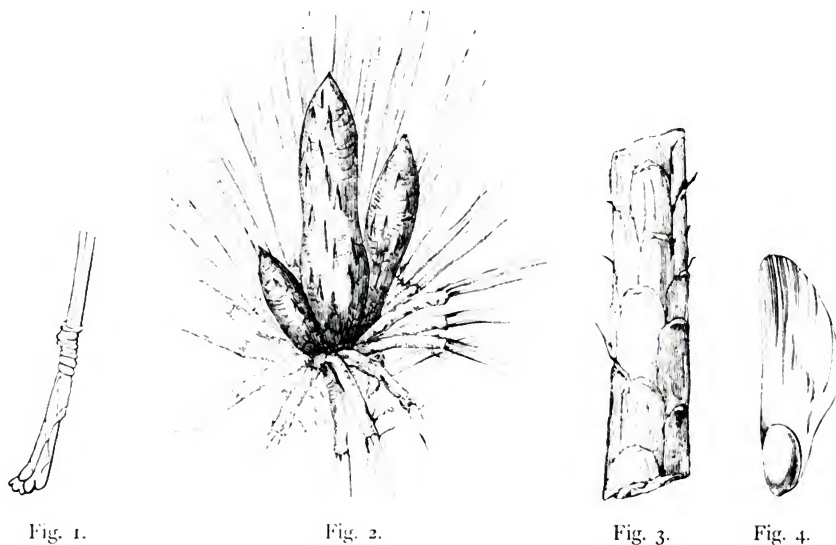
PINUS JEFFREYI.

IDENTIFICATION.—PINUS JEFFREYI—Balfour in Circular by *Edin. Oreg. Botan. Assoc.* Carrière, *Traité Gén. des Conif.*, p. 358 (1855).
Gordon, *Pinctum*, p. 198 (1858). Murray, in *Edin. New Phil. Jour., New Series*, April 1860, xi. p. 224; and *Trans. Edin. Bot. Soc.*, vi. p. 350.

ENGRAVINGS.—*Conc.*—Balfour, *loc. cit.*; Murray, *loc. cit.*
Tree.—Murray, *loc. cit.*

Specific Character.—Pinus foliis ternis elongatis fortibus, vaginis longis laceris, strobis sub-inequaliter oblongo-ovatis, squamis apophysi mucronato, mucrone incurvato, feminibus ala plus duplo brevioribus.
Habitat in California prope Shasta.

A large tree. Leaves in threes, 8 or 9 inches long, glaucous green, subtriangular, rounded on the outer side, slightly keeled on the inner side, ferrate on the margins, with about 10 stomata on the rounded back, and 5 on each side of the keel on the inner sides. Sheath brownish, about $1\frac{1}{4}$ inch long, with separate scales at the base [fig. 1]. The leaves grow only at the end of the branch. The buds are rather large, swelling at the base and near the point, and covered with a hoary bloom [fig. 2]. The bark of the young twigs is first greenish, then fawn-coloured; the pulvini are broad and flat [fig. 3]. The older branches are brown. The inflorescence has not yet been observed. Cones large, ovate, from 7 to 8 inches long and from 9 to 11 inches in circumference at the broadest part, rather more developed on the outer than the inner side, which rests next the stem of the branch. Scales $1\frac{1}{2}$ inch long, with a somewhat pyramidal apophysis and a hooked umbo, the hook being 2-10ths of an inch long, and slightly incurved. Seeds about 4-10ths of an inch in length, dark brown, winged, rather less than a third of the length of the wings; wings rather more than an inch in length, marked with dark striæ [fig. 4].



Description.—A tree reaching a height of 150 feet, and 4 feet in diameter. So far as we may judge from report, and the figure of the tree given in the "Edinburgh Philosophical Journal," *loc. cit.*, it cannot be said to be a handsome tree, but may be described as looking naked and tufty. The beautiful cone, however, is in itself an object of attraction.

Geographical Distribution.—Found by Jeffrey, in Shasta Valley, in North California. Also by Peebles, on the top of Scot's Mountain, one of the Shasta range, a locality where snow falls early and lies late.

History.—We owe the discovery and introduction of this tree to the Edinburgh Oregon Botanical Association. That Association was established in 1850, by a number of Scottish arboriculturists, with the
[8] object

object of sending a collector to North-West America. Many of the trees in that country are restricted to narrow limits; and it was thought probable that in the vast unexplored country lying west of the Rocky Mountains many important discoveries remained to be made. How just these expectations were, was shewn afterwards by the discoveries actually made by Jeffrey, by those of Murray, Beardley, Lobb, Bridges, Peebles, Parry, and other explorers. The chief movers in establishing the Society were the late good Lord Murray, Sir William Gibson-Craig, and Mr George Patton of the Cairnies; and by their personal influence a body of subscribers, about 350 in number, in a few months joined it. Of these many were from England (among others H.R.H. the Prince Consort), but most of them were landed proprietors in Scotland. The funds subscribed by these gentlemen enabled them to send out a collector, and to keep him in North-West America for three years. Their object was felt to be of that liberal and patriotic nature, that special facilities were extended to them by various departments of Government, by the Hudson's Bay Company, and every public body with whom they came in contact.

The Committee appointed as their collector Mr John Jeffrey, a young gardener from Fifeshire, born, we believe, on the estate of Lochore, the maternal patrimony of the late Sir Walter Scott, and then employed in the Edinburgh Royal Botanic Garden. He had attracted the attention of Professor Balfour and Mr Macnab, as well as of some of the members of Committee who were in the habit of frequenting the garden, by his zeal and intelligence, and had carried off the prize offered to practical gardeners for the best collection of dried plants made in the neighbourhood of Edinburgh. Mr Jeffrey was appointed in the spring of 1850, and left England in June of that year in one of the Hudson's Bay Company's vessels, bound for York Factory, in Hudson's Bay. On his arrival there he accompanied the Company's despatch brigade, which was then wont every year to cross the continent in winter, and proved that he possessed at least one important requisite of a collector, by the readiness with which he bore, nay enjoyed, the hazards, the labours, and exposures of this winter journey. By this energetic course Mr Jeffrey saved a season. He was on his ground in the spring of 1851, and for the whole of that year he devoted himself zealously to exploring and collecting. Among the coniferous produce of his collections were *Pinus Banksiana*, *P. flexilis*, *Abies Pattoniana*, *A. Douglassii*, *A. Menziesii*, and *Picea lasiocarpa*, besides many other interesting plants.

In his second year, Jeffrey went further south, and sent home supplies of seeds of *Picea nobilis* and *P. amabilis* (Lambert's *P. grandis*), *Pinus tuberculata* and *P. contorta*; and, besides the very interesting *P. Balfouriana* and *Thuja Craigana*, he then discovered the species of pine which we are now describing, which was named by the Association after him, in recognition of his services. His collections in the second year, however, scarcely kept pace with those of the first year; and in the third year a very marked falling-off in the consignments, accompanied by a total cessation of correspondence, led to his engagement being brought to a termination. What became of Jeffrey afterwards is not known. He was last heard of at San Francisco, where, it was said, he had joined an American expedition to explore the Gila and Colorado. His fate will probably ever remain a mystery. Had he still survived, some token of his existence must surely have reached his friends in this country, or those who had previously met with him in his three years' explorations in Oregon. The Hudson's Bay Company's officers had been so pleased with him during the time he spent in their territories, that they were anxious to secure his services after the Association had brought their engagement with him to a close; and we believe they took some trouble to find him out for that purpose, but without success. It has been surmised that he had become enamoured of the life of the trapper, or "mountain boy," and had probably lost his life at an early period in some of the perils incidental to that adventurous occupation. Be that as it may, the name of the present species will soon be all that remains to call to mind his existence and short career.

Culture.—It is perfectly hardy, and already a considerable number of young plants, raised from the seeds sent by Jeffrey and from subsequent importations, is to be found in this country.

Commercial Statistics.—Price in 1855 for one-year seedlings 9s., and for two-years, 15s. each. In 1863, plants from 4 to 6 inches, 3s. 6d.; 12 to 18 inches, 7s. 6d.; and 18 to 24 inches, 10s. 6d. each.



Pinus lambertiana Douglas.

PINUS LAMBERTIANA, Douglas.

The SUGAR PINE of the Californian settlers.
NAT-CLEH, in the Umpqua Indian language.

IDENTIFICATION.—PINUS LAMBERTIANA, Douglas, in *Linn. Trans.*, xv. p. 500 (1828); Hooker, *Flor. Bor. Amer.*, ii. p. 161 (1829-40); Lambert, *Genus Pinus*, p. 57 (ed. 1832); Lawton, *Agric. Manual*, p. 361 (1836); Loudon, *Arboretum*, iv. p. 2288 (1838); Forbes, *Pinet. Woburn.*, p. 77 (1839); Antoine, *Conif.*, p. 41 (1840-46); Loudon, *Encycl. of Trees*, p. 1909-12 (1842); Spach, *Hist. Nat. Vég. Phaner.*, xi. p. 397 (1842); Nuttall, *Sylva*, iii. p. 122 (1842); De Chambray, *Traité Prat. Arb. Rés. Conif.*, p. 346 (1845); Endlicher, *Syn. Conif.*, p. 150 (1847); Knight, *Syn. Conif.*, p. 34 (1850); Lindley and Gordon, *Journ. Hort. Soc.*, v. p. 215 (1850); Lawton, *Abietinea*, p. 25 (1851); Carrière, *Traité Gén. des Conif.*, p. 307 (1855); Newberry, *U. S. Pacif. Rail. Rep.*, vi. p. 42 (1857); Gordon, *Pinetum*, p. 228 (1858).

ENGRAVINGS.—Cones, Leaves, &c.—Lambert, *Genus Pinus*, ed. 2, t. 34; Antoine, *Conif.*, t. 19; Loudon, *Arboretum*, iv., figs. 2203-6; Forbes, *Pinet. Woburn.*, t. 30; Nuttall, *Sylva*, iii. t. 14; Newberry, in *U. S. Pacif. Rail. Rep.*, vi. t. 14.
Trees.—Loudon, *Arboretum*, iv., fig. 2202 and fig. 2207 (young plants).

VAR. BREVIFOLIA—Hooker, loc. cit. *supra*.

Specific Character.—P. foliis quinis modice longis carinato-trigonis filiformibus sat rigidis, tactu leviter ferratis; vaginis brevissimis caducis; strobilis magnis longissimis cylindricis utrinque obtusis; squamis laxis apice subrotundatis; umbone terminali dilatato obtusissimo; feminibus magnis ovatis, alis membranaceis fuliginosis sat latis, testa nigrofusca crustacea.

Habitat in Oregon et California.

VAR. BREVIFOLIA.—Foliis brevioribus et rigidioribus.

Habitat in Montibus Rupestribus ("Rocky Mountains").

Leaves in fives, from 3 to 5 inches long, firm, glaucous, with a bluish-white bloom, numerous, roughened along the midrib and edges by ferratures invisible to the naked eye, the ferratures directed to the point of the leaf. Sheath very short, about a line in length. The leaves make one full spiral from top to bottom, the edge on the right hand at the bottom, being on the left at the top. (In *P. Monticola* they make half a turn, the edge on the left hand at the bottom being on the back at the top. In *P. Strobis*, *Ayacahuite*, and *excelsa*, there is no perceptible spiral turn.) The point of the leaf is acute and somewhat sword-shaped. The ferratures on the leaf are very slight, and less frequent towards the point: at the middle and base of the leaf the distance between each ferrature is generally about half the breadth of the leaf; towards the point the distance becomes one and a half or twice the breadth of the leaf [fig. 1]. If the ferratures of the leaf are to be made use of as a specific character, the necessity of taking some such standard as this for estimating their relative size and frequency must be obvious. The leaf is trigonal, the back being convex, and the two sides somewhat concave. On all three the stomata are disposed in three or four rows, some-



Fig. 1.

times in as many as five, and sometimes interrupted, and at the point terminating in two: the normal number is three.

The disposition or distribution of the stomata is a specific character of which we do not think so much use has been made as might have been. Applying it to the section *Strobus* (to which our present species belongs), it would give the following easy dichotomous table for distinguishing the species by inspection of a fragment of the leaf, viz. :

<i>Strobus.</i>			
1	{	Stomata on the back as well as on the two sides of the leaf,	<i>P. Lambertiana.</i>
		Stomata on the sides but not on the back of the leaf,	2
2	{	Stomata arranged in five rows, placed closely together,	<i>P. excelsa.</i>
		Stomata arranged in fewer than five rows,	3
3	{	Stomata arranged normally in four rows,	<i>P. Ayacahuite.</i>
		Stomata arranged normally in three rows,	<i>P. monticola.</i>
		Stomata arranged normally in two rows,	<i>P. Strobus.</i>

As the number of rows varies in exceptional cases, in the same way as the number of leaves in a fasciculus itself varies, such a table as the above cannot be taken as absolute, but merely as a useful adjunct to more detailed description.



Fig. 2.

The origin of the young leaves, at and towards the ends of the branches, is surrounded by a bract or sheath, composed of three leaflets, there being none on the side next the stem [fig. 2]. This soon drops off. The older leaves then spring from a cortical tumour or corrugated eminence [fig. 3].



Fig. 3.

The odour of the cut twig of *Pinus Lambertiana* is peculiar, and quite distinct from that of any other Pine we have met with. It has a dash of lemon in its flavour. The bark is smooth. On the southern side of the tree, pale brown; on that looking to the north, whitish. Cotyledons, 12-13. Mature cones, growing dependent towards the ends of the branches, from 12 to 18 inches long, and 3½ to 4 inches in diameter at the broadest part, of an elongate conical shape, slightly curved, but without any difference between the scales on the outer and inner side. Scales 2½ inches in length, and 1¼ inch across at the broadest part, with a small transverse umbo, reminding us of the nail at the end of a duck's bill. Seeds winged, large sub-oval (one side somewhat angular), dark brown, three-quarters of an inch in length, and half an inch across. Wings membranaceous, semi-transparent, including the seeds 1¼ inch in length and three-quarters of an inch across, fuliginous in colour, with a multitude of sinuous vessels interspersed over them; crimson when fresh, blackish when dry, and forming a beautiful object under the microscope. Testa crustaceous, cracking easily under pressure. Buds about an eighth of an inch long and an eighth of an inch broad, roundish and pointed, with smaller buds beside it.

Description.—This species belongs to the section of Pines known as the “Weymouth Pines.” It is closely allied to *Pinus Strobus* of the Eastern States of North America, and *Pinus excelsa* of the Himalayas. It exceeds all trees of the Pine genus in height and magnitude, coming undoubtedly, of all productions of the vegetable kingdom, next, in these particulars, to *Wellingtonia gigantea* and *Sequoia sempervirens*.

The mature tree reaches a height of 300 feet, with a diameter of 20 feet at the base. It is not often, however, that it reaches these extreme dimensions. Even where it is abundant, and the general growth vigorous, it is rare to find a tree more than 10 feet in diameter and 200 feet in height. Mr Blake, in his Geological Report (*U. S. Pacific Railroad Reports*), speaks of a trough which he saw used for mining purposes, cut from a single log, 20 feet long, 3 feet wide, and 2 feet deep. The trunk generally stands without flaw or flexure, a perpendicular cone, with all its transverse sections accurately circular; it is usually without branches for about two-thirds of its height. Douglas says that “the branches are pendulous, and form an open

PINUS LAMBERTIANA.

3

open pyramidal head, with that appearance which is peculiar to the *Abies* tribe." A copy of a rude sketch of the tree drawn by him in his Journal is shewn in fig. 4. Dr Newberry, again, says, more poetically, that the trunk is "sparfely fet with branches, which, in their magnificence, seem like the festoons of ivy which wreath the columns of some antient ruin;" a description which would be most certainly happy if applied to *Wellingtonia*, and is probably well applied to this tree. Speaking of the young trees in their native country, he adds, "The young trees of the Sugar Pine give early promise of the majesty to which they subsequently attain. They are unmistakably *young giants*, even when having a trunk with a diameter of a foot or more; their remote regularly-whorled branches, like the stem, covered with smooth greyish-green bark, shewing that, although so large, the plant is still 'in the milk,' and has only begun its life of many centuries."

The foliage is of a bluish-green colour, moderately dense. As in *P. Strobilus*, towards the summit of the tree a few of the branches are frequently longer than those below; and from the extremities of these, as well as the other branches, singly, or in clusters, hang the enormous cones. The cones are two years in acquiring their full growth. At first they grow upright, but begin to droop in the second year. They ripen early in the year. Near Monterey, not far south of San Francisco, Hartweg found the cones already open and the seeds fallen out by the 20th of September. They are less resinous than those of *P. Strobilus* or *excelsa*. The seeds have a pleasant nutty flavour. The timber is white, soft, homogeneous, light, and usually straight-grained. Douglas found it to abound in turpentine reservoirs, and that the specific gravity of a specimen sent to England was 0.463. As in the other great trees, the annual layers in large specimens of *P. Lambertiana* are very narrow. In Douglas's specimen there were fifty-six in the space of $4\frac{1}{2}$ inches next the outside.

Geographical Distribution.—This gigantic Pine is widely distributed over the whole country lying between the Rocky Mountains and the Pacific. According to Dr Newberry (the most recent explorer), its range extends from the Mexican line on the south to the vicinity of the Columbia River. It is diffeminated through nearly all parts of the Sierra Nevada within their limits, and is not rare in the coast-ranges between San Francisco and the Umpqua River. It is also generally spread over the transverse ranges of mountains (Siikiyau, Umpqua, and Calapooya) which connect the cascades and coast-ranges; and probably the finest trees of it which exist are in the vicinity of Humboldt Bay and Rogue River, on the coast. Douglas found it beyond a range of mountains running in a south-westerly direction from the Rocky Mountains towards the sea, and terminating at the Cape Orford of Vancouver. He says that it grows sparingly upon low hills and the undulating country east of the range of mountains just mentioned, where the soil consists entirely of pure sand, and in appearance is incapable of supporting vegetation. Here he found it attain its greatest size, and perfect its fruit in most abundance. He adds, "The trees do not form dense forests, as most of the other Pines which clothe the face of North-west America; but, like *P. resinosa*, which grows among them, they are scattered singly over the plains, and may be considered to form a sort of connecting link between the gloomy forests of the north and the more tropical-looking verdure of California." Dr Newberry on the same point observes: "I have never seen it anywhere existing in such numbers as of itself to form forests, but generally occurring associated with other species which far surpass the Sugar Pines in numbers, while they, in turn, exceed all their fellows in dimensions. Scattered here and there through the forest, they seem, in their towering grandeur, like so many chiefs surrounded by their subjects and slaves;" and, in his Report on the Zoology of the country, incidentally remarks, "About Shingletown and the Cumbers Flat, north-east of Fort Reading, and around the base of Lapens Butte, the grizzly bears are very numerous. This region is partially covered with a forest of rather scattered trees, of immense size, of Sugar and Yellow Pine (*P. ponderosa*), Western Balsam Fir (*P. grandis*), and *Libocedrus*, with wide intervals covered with a dense growth of *Manzanita*, *Ceanothus*, and low Scrub Oak. These thickets are the favourite haunts of the bear, and are intersected in every direction by their well-beaten paths." Of the district here alluded to, he elsewhere says, "At the Cumbers and Shingletown in Northern California, the saw-mills are set in what must be a lumberman's paradise: a forest composed of trees of remarkable size,

perfection, and uniformity, Sugar and Yellow Pine, with the Western Balsam Fir, and *Libocedrus*; of which the eye may take in at a glance even hundreds, which reach or exceed the utmost capacity of the mills, and many which would furnish sticks a yard square and a hundred feet long, as straight as an arrow, and almost without a knot."

History.—As already mentioned, this tree was first made known to us by Douglas, who met with it when collecting in Oregon for the Horticultural Society of London. He published a description of it in a paper read before the Linnean Society; but a fuller and more graphic account of his discovery of it is to be found in his MS. Journal, which is still preserved in their Archives by the Royal Horticultural Society, along with those of their other collectors. The Council of that Society have liberally accorded their permission to make use of it; and it may gratify the reader to quote the various passages relating to this tree, and trace the stages by which he secured it: for from these it appears that it was not merely a hap-hazard accidental discovery, but one due to an intelligent and assiduous search after an object of which he had obtained a transient indication.

The first quotation is taken from his Journal in August 1825 (and the reader is requested to take its relevancy upon trust). Douglas had then made an expedition to the southward of the Columbia, along with a party of men going on a hunting excursion to the Multnomah River, one of the branches of the Columbia. There he met with a small native plantation of *Nicotiana pulverulenta* (a species of tobacco). He had often sought for this plant, which had been stated to be a native of this country, but hitherto without success. "The natives cultivate it here," says he; "they do not cultivate it near their camps or lodges, lest it should be taken for use before maturity. An open place in the wood is chosen where is dead wood, which they burn, and sow the seeds in the ashes. Fortunately I met with one of the little plantations, and supplied myself with seeds and specimens without delay. On my way home I met the owner, who, seeing it under my arm, appeared to be much displeased; but by presenting him with two finger-lengths of tobacco from Europe, his wrath was appeased, and we became good friends. He then gave me the above description of the mode of cultivating it. I was much pleased with the idea of their using wood ashes, shewing that even the savages on the Columbia have observed their good effects. His knowledge of plants and their uses gained him another finger-length. When we smoked, we were all in all." Here he got the first indication of the *Pinus Lambertiana*. We shall presently see that from this savage's tobacco-pouch he had got a seed or two of that Pine, and never lost sight of the hope of finding the Pine itself until he secured it.

The next glimpse of it is the following: While in that district he "made a trip to the opposite side: two days after, also to the summit of the hills, which I found of easier ascent; only slept one night near the top. My food during my stay was fresh salmon, without salt, pepper, or any other spice, with a very little biscuit and tea, which is a great luxury after a day's march. Collected the following, which did not come under my observation before: 462 *Pinus* *sp.*, a tall splendid tree, leaves glaucous. The cones being on the top, I was unable to procure any: all the trees were too large to be cut down with my small hatchet; and as to climbing, I have already learned the propriety of leaving no property at the bottom of the tree. I went up one, but the top was too weak to bear me. The height was so great that I could not bring down any cones with buck-shot.* Make a point of obtaining it by some means or other." Twelve months after he is still in search of it. While near the Umpqua River on 17th October 1826, he writes, "The country towards the upper part of the river appears to be more varied and mountainous, and perhaps will afford my wished-for Pine, being nearer the spot described to me in August 1825 by an Indian, while on the Multnomah, in whose smoking-pouch I found some of its large seeds." On the 25th of the same month is, "Made a short stay, and took my course southerly towards a ridge of mountains, where I hope to find my Pine." And at last, on the 26th: "Weather dull and cloudy. When my people in England

are

* This may be the reason why he does not notice the extraordinary magnitude of the cones, which must have struck him too much to have allowed him to pass it over in silence had he once handled them.

PINUS LAMBERTIANA.

5

are made acquainted with my travels, they may, perhaps, think I have told them nothing but my miseries. That may be very correct; but I now know that such objects as I am in quest of are not obtained without a share of labour, anxiety of mind, and sometimes risk of personal safety. I left my camp this morning at daylight on an excursion, leaving my guide to take care of the camp and horses until my return in the evening, when I found everything as I wished; and he had in the interval dried my wet paper, as I had desired him. About an hour's walk from my camp I was met by an Indian, who, on discovering me, strung his bow and placed on his left arm a sleeve of racoon skin, and stood ready on the defence. As I was well convinced this was prompted through fear, never before having seen such a being, I laid my gun at my feet on the ground, and waved my hand for him to come to me, which he did with great caution. I made him place his bow and quiver beside my gun, and then struck a light and gave him to smoke and a few beads. With my pencil I made a rough sketch of the Cone and Pine I wanted and shewed him it; when he instantly pointed to the hills about fifteen or twenty miles to the south. As I wanted to go in that direction, he, seemingly with much good-will, went with me. At mid-day I reached my long-wished-for *Pinus*, and lost no time in examining and endeavouring to collect specimens and seeds. New or strange things seldom fail to make great impressions, and we are often at first liable to overrate them. And now, lest I should never see my friends to tell them verbally of this most beautiful and immensely large tree, I now state the dimensions of the largest one I could find that was blown down by the wind: three feet from the ground, 57 feet 9 inches in circumference; one hundred and thirty-four feet from the ground, 17 feet 5 inches; extreme length, 215 feet. The trees are remarkably straight; bark uncommonly smooth for such large timber, of a whitish or light-brown colour, and yields a great quantity of gum of a bright amber colour. The large trees are destitute of branches generally for two-thirds of the length of the tree; branches pendulous, something like this [fig. 4], and the cones hanging from their points like small fugar-loaves in a grocer's shop. It being only on the very largest trees that cones are seen, the putting myself in possession of three cones (all I could) nearly brought my life to an end. Being unable to climb or hew down any, I took my gun and was busy clipping them from the branches with ball, when eight Indians came at the report of my gun. They were all painted with red earth, armed with bows, arrows, spears of bone, and flint knives, and seemed to me anything but friendly. I endeavoured to explain to them what I wanted, and they seemed satisfied and sat down to smoke; but had no sooner done, than I perceived one string his bow and another sharpen his flint knife with a pair of wooden pincers, and hang it on the wrist of the right hand, which gave me ample testimony of their inclination. I could not save myself by flight; and without any hesitation I went backwards six paces and cocked my gun, and then pulled from my belt one of my pistols, which I held in my left hand. I was determined to fight for my life. As I as much as possible endeavoured to preserve my coolness, and perhaps did so, I stood eight or ten minutes looking at them and they at me without a word passing, till one at last, who seemed to be the leader, made a sign for tobacco, which I said they should get on condition of going and fetching me some cones. They went, and as soon as they were out of sight I picked up my three cones and a few twigs, and made a quick retreat to my camp, which I gained at dusk. The Indian who undertook to be my last guide I sent off, lest he should betray me. Leaves short in fives, with a very short sheath, bright green; cones, one 14½ inches long, one 14, and one 13½, and all containing fine seed. A little before this the cones are gathered by the Indians, roasted on the embers, quartered, and the seeds shaken out, which are then dried before the fire and pounded into a sort of flour, and sometimes eaten round (*à la*). How irksome night is to such a one as me under my circumstances! cannot speak a word to my guide; have not a book to read; constantly in expectation of an attack; and the position I am now in is lying on the grass, with my gun beside me, writing by the light of my Columbian candle, namely, a piece of wood containing resin."

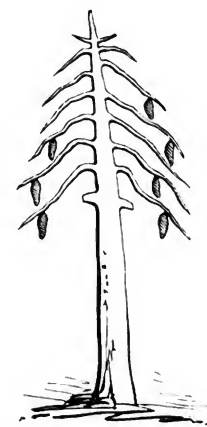


Fig. 4.

Eight savages, in their war-paint, stringing their bows against a single individual, is rather too great

odds, and Mr Douglas's courage need moult no feather although he did make a precipitate retreat when no man pursued. But, seated quietly at our own fireside, and reflecting on the circumstances with the light which we now possess, from our greater knowledge of the habits of the natives, we may venture to say that, had Douglas kept his ground and waited their return, he would have been agreeably surprised by finding them bearing a large supply of the seeds ready shelled. Their ready and unanimous departure indicates a defined object, which they knew they could accomplish. It was not to disperse to search and climb for cones, which were growing on the trees around them; but, possessing plenty of the seeds in their lodges, they rushed off, with the one-ideaed impetuosity of a schoolboy, to procure the desired article. When Mr William Murray, in one of his expeditions (1854), looked about for some shorter and less expensive mode of procuring the seed of *P. Lambertiana* than cutting down these enormous trees, he found that he could obtain them in quantity, ready shelled, from the natives for some trifling recompense; and actually thus procured and brought away with him several pecks of the seed in the finest order. But, even supposing that Douglas by waiting might have received a good supply of the seeds, the question remains, whether, after the interchange of tobacco for seeds was over, some new ruling idea might not have seized the group, to be followed with equally unreasoning vehemence—such as the beauty of his gun and pistols, and their peculiar fitness for themselves. Douglas, therefore, undoubtedly exercised a wise discretion in distrusting the impulses of these “children of nature.” In subsequent letters, written some years afterwards, he mentions that in each of the two years following the incident above related, a party of whites had been massacred by the Indians of that district; in one of them only one individual escaping to tell the tale.

The name “*Lambertiana*” was given to it by Douglas in honour of Mr Aylmer Bourke Lambert, of Boyton House, near Heytesbury, Wilts, who was the last survivor of the original members of the Linnean Society, and for nearly fifty years one of its Vice-Presidents. He was born in 1761. From his college days to his death, in 1842, he was ardently attached to the study of natural science, and amassed one of the largest botanical collections then in existence. He is chiefly interesting to the students of Coniferae from having published the magnificent work intitled “*A Description of the Genus Pinus*,” cited above. It was first published in London, in 1803, in folio, and a supplementary volume in 1825; and is one of the most splendid botanical publications that ever issued from the press. A second edition, with additions, was published in 1828, and a third volume was added in 1834. A smaller edition, in imperial octavo, was published in 1832. This is composed of the same matter as the 1828 edition, and the plates seem to be excised portions of the larger plates, crowded together in a smaller compass. It is right to add that the chief part of the descriptions in that work was executed by Mr Don, who was for many years curator of Mr Lambert's collection and library.

Introduced into Europe in 1827.

Properties and Uses.—The timber, as already mentioned, is soft, white, straight in the grain, and homogeneous. In California it is esteemed beyond all other Pines for “inside work,” such as floors, doors, and house carpentry in general.

The juice or resin is white and semi-transparent, crumbly, and not very tenacious. Where a tree has been partially burnt, the resin which exudes from it seems thereby to have its properties altered. It in a greater measure loses its terebinthine taste and smell, and acquires a sweetish taste like sugar, whence the name (Sugar Pine) which the tree has received from the settlers. It is sometimes used by them for sweetening their food, but more frequently as a medicine than a condiment, on account of the decided cathartic properties which it possesses. Its resemblance in taste, appearance, and properties to manna is very close; as Dr Newberry says, “but for a slight terebinthine flavour, it might be substituted for that drug without the knowledge of the druggist or physician, its physical and medical properties are so very like.” Dr Lyon Playfair, Professor of Chemistry in the University of Edinburgh, has had the kindness to analyse a portion of it, and found it all but identical in its properties with manna, although the portion placed at his disposal was too small to allow him to make a reliable quantitative analysis. According to Berthelot (*Compt. Rend.*

PINUS LAMBERTIANA.

7

1855, No. 12, p. 452, t. xii.), who describes the body in question under the name of *Pinite*, it possesses right polarisation, and is incapable of fermentation, even after treatment with fulphuric acid. Its analysis led to the formula, C_{12}, H_{12}, O_{10} . Acetate of lead-oxide ammonia precipitates from its solutions the compound, $C_{12}, H_{12}, O_{10}, 4Pb O$. It is isomeric with *Quercite*, but differs from that body in crystalline form, and has a greater solubility and sweetness. In another paper Berthelot describes a large number of sugars and acids. Among these are the acid and neutral stearates and benzoates of *Pinite*. He has further found that when these compounds are saponified there is obtained the original acid, and not *Pinite*, but a substance which gradually passes into *Pinite*. The name *Pinite* is objectionable, as identical in orthography with one appellation of a mineral which is overloaded with synonyms.

M. Bourfier de la Rivière says that it is only the old trees which produce this saccharine juice. He adds that from the alburnum only resin flows, and that it is from the wood alone that the sugar is procured.

Mr Gordon seems to have oddly misapprehended what is related of the resin. He says the seeds "are used for food by the Indians, as well as the resin, which is freely produced by the tree when wounded; *roasted as a substitute for sugar*." If he speaks of the seeds in the words which are italicised, they are used as food—not as a substitute for sugar; if of the resin, which is or may be used as a substitute for sugar, it is not the resin which is roasted to make it so, but the tree which is roasted to make it produce the sugary resin. Bourfier de la Rivière says that he lived upon it in the mountains. Douglas says that the *seeds* are eaten by the natives *roasted*, or are pounded into coarse cakes for their winter store. Mr William Murray saw them making these cakes, and found them more elaborate in composition. Those he met with were round balls, composed of the seeds of the Sugar Pine, or of *Pinus Sabiniana*, mixed with grasshoppers or locusts and large acorns (of *Quercus densiflora*?). Mr Murray did not taste these balls or cakes. He had no objection to the seeds of the Pines, which were very good, nor to the acorns—he could even have managed the locusts; but he could not overcome his disgust at the filthiness of the manipulation by the squaws in preparing the "cakes."

As to the goodness of the seeds to eat there can be no doubt: we speak from personal experience; and Douglas, in his paper in the 'Linnean Transactions,' mentions that he had been informed by Mr Menzies that, when he was on the coast of California with Captain Vancouver in 1793, seeds of a large Pine, resembling those of the Stone Pine, were served at the dessert by the Spanish priests resident there. "These," says he, "were no doubt the produce of the species now noticed;" or just as probably of *P. Sabiniana*, which has a seed somewhat like it, as well in appearance as taste. Other animals as well as ourselves appreciate the seeds as an article of food. Jeffrey, in one of his communications to the Committee of the Edinburgh Oregon Botanical Association, says, "I am sorry to have to relate an accident which deprived me of a fine stock of the seeds of *P. Lambertiana*. I was encamped one night and had a small sack of its seeds along with me. During the night a ground rat found them out, and appropriated them all except about two dozen."

Cultivation, &c.—The quantity of seed sent home by Douglas was small. Of the plants reared from it two were figured by Loudon in his *Arboretum* (loc. cit.), one growing in the Arboretum of the Royal Horticultural Society at Chiswick, and the other at Red Leaf, Penshurst, Kent, the seat of William Wells, Esq. The former is 28 feet 6 inches in height, but still a bushy tree, retaining the character shown in the figure of it given by Loudon two-and-twenty years ago. This small amount of growth and bushy character is due to the soil at Chiswick, which is very unfavourable to coniferous trees. The tree at Red Leaf died in 1845, being then about thirteen years old and 25 feet 6 inches in height. Mr Wells, however, has a tree from a branch inarched upon a Weymouth Pine, planted in 1839, and now about 35 feet high. At Castle Martyr, near Cork, the seat of the Earl of Shannon, there is a plant 35 feet in height and 3 feet in circumference at the base. It was planted subsequently to 1845. The climate and soil of that district seem peculiarly favourable to the growth of coniferous trees, as will appear from the various references to it in the course of this work. The geological formation of the country is clay-slate, old red sandstone, and lime-

stone; and it is on the clay-slate and old red sandstone that the plants of this tree have made the most rapid progress. Loudon mentions that almost all the plants distributed by the Society from the seed sent by Douglas died at about five or six years old. Young plants of this, and some others of Douglas's pines, were supplied by the Horticultural Society to the King of Prussia, but we have not heard how they prospered. Perhaps the mention of the circumstance may induce some one, who has the opportunity, to make inquiries after them, and let the public know their fate. The sandy soil of Prussia, we imagine, would be very unpropitious to this tree, as it is to most Coniferae.

With the view of assisting in the identification of the young plant, we give figures, full size, of a seedling. Fig. 5 shews the general appearance, and fig. 6 a plan. We also append a drawing, on a scale

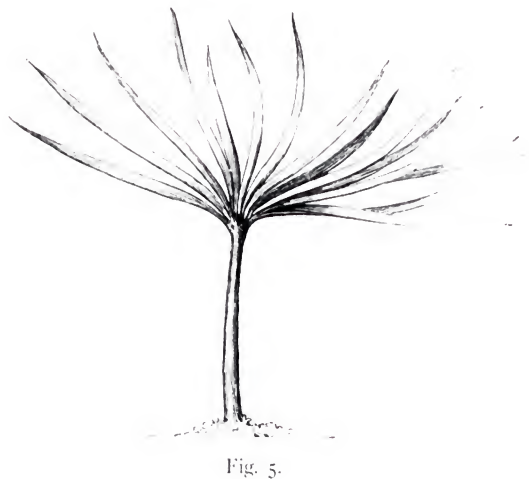


Fig. 5.

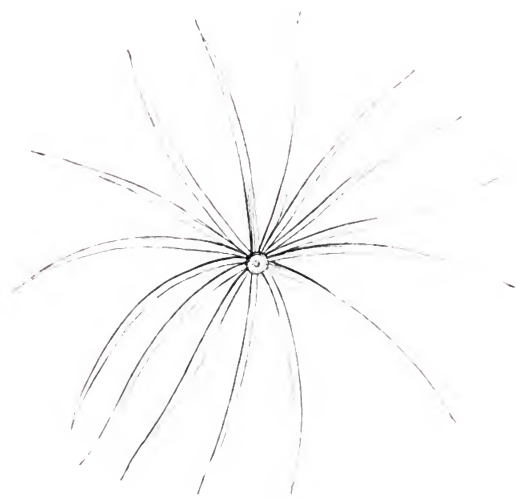


Fig. 6.

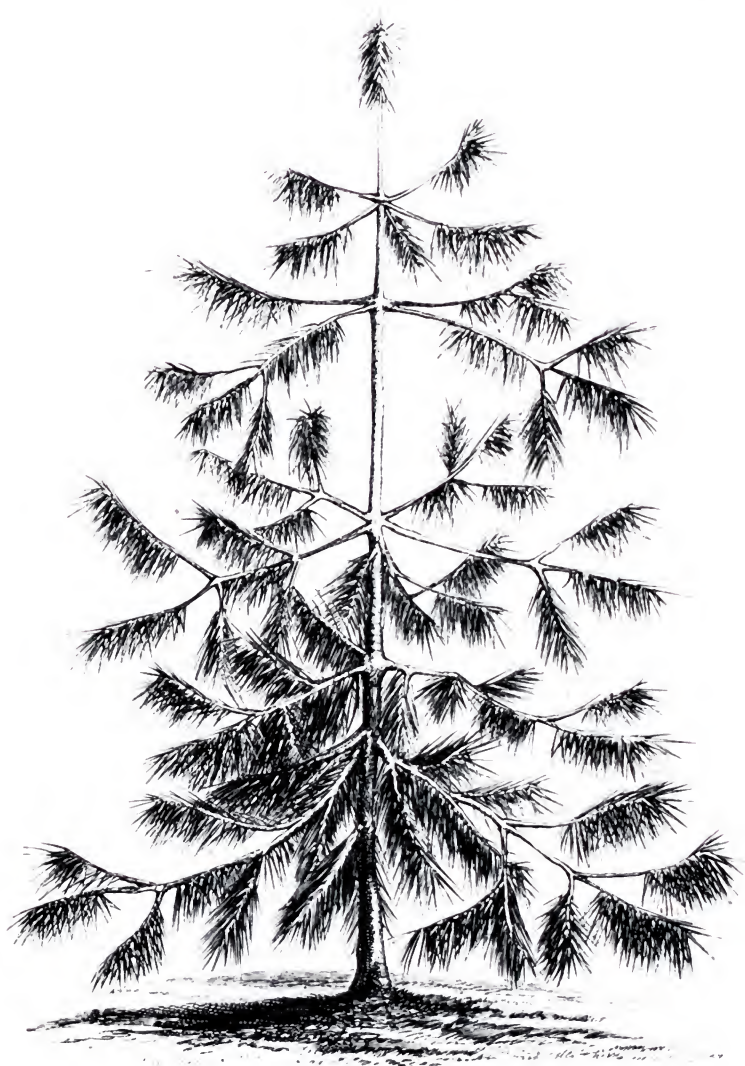


Fig. 7.

of one inch to the foot, of a specimen [fig. 7] growing in our nursery grounds near Edinburgh. It was sown in 1854, and is now (1862) 6 feet high.

The seed springs readily in this country, and may be sown at once in the open border, requiring no protection. It has proved to be perfectly hardy. It passed the test of the severe winter of 1853-54 unhurt; and even the winter of 1860-61, which is the severest which has occurred since it was introduced, and probably as severe as any it is ever likely to encounter in this country, has done it no harm.

No particular directions are required for its planting or treatment.

Commercial Statistics.—The price in 1840-42 was 50s. for plants 1 foot high; in 1850, for grafted plants, 7s. 6d.; and in 1860, for seedlings one year old, 2s. 6d.—two years old, and one and two years transplanted, 5s. to 7s. 6d. each. It is not to be found in great stock in the nurseries.



Jas Black Del

Hob Black Fac

PINUS LARICIO. Poir.

Printed from Zinc, by W & A K Johnston, Edinburgh

PINUS LARICIO

IDENTIFICATION.—PINUS LARICIO. Poiret, *Dict.*, v., p. 339 (1804); De Cand., *Fl. Fr.*, iii., p. 274 (1805); Desfont., *Hist. Arb.*, ii., p. 611 (1809); Loiseleur des Longchamps, *Nouv. Duham.*, v. (1801-19); Lambert, *Genus Pinus*, ed. 2, i., p. 9 (1832); Loudon, *Arboretum*, iv., p. 2200 (1838); Forbes, *Pinet. Woburn.*, p. 23 (1839); Loudon, *Encycl. of Trees*, p. 957 (1842); Antoine, *Conif.*, p. 3 (1840-6); De Chambray, *Traité Prat. Arb. Rés. Conif.*, p. 245 (1845); Link in *Linnaea*, xv., p. 494 (1841); Schouw, *Annal. Sc. Nat.*, 3rd ser., iii., p. 234 (1845); Spach, *Hist. Veg. Phan.*, xi., p. 384 (1842); Lindley and Gordon, *Journ. Hort. Soc.*, v., p. 219 (1850); Knight, *Syn. Conif.*, p. 27 (1850); Carrière, *Traité Gen. des Conif.*, p. 384 (1855); Gordon, *Pinetum*, p. 168 (1858), and *Supplement*, p. 60 (1862), ed. 2, p. 239 (1875); Henkel and Hochstetter, *Syn. des Nadelholz*, p. 46 (1865); Parlature, *Flora Italiana*, vol. iv., p. 52 (1867); et in *D. C. Prod.*, xvi., sect. 2, p. 386 (1868); Veitch, *Manual*, p. 147 (1881). [See NOTE at foot.]

PINUS SYLVESTRIS & MARITIMA. Aiton, *Hort. Kew.*, ed. 1, iii., p. 366 (1789).

PINUS MARITIMA. Miller, *Gard. Dict.*, 7 (1795); Aiton, *Hort. Kew.*, ed. 2, v., p. 315 (1810-13); Koch, *Dendrologie*, ii., part 2, p. 286 (1873).

PINUS LARICIO & POIRETIANA. Endlich., *Syn. Conif.*, p. 178 (1847).

PINUS ALTISSIMA. Hort.

ENGRAVINGS.—*Cones and Leaves*—Loiseleur des Longchamps, *Nouv. Duham.*, t. 67, et t. 71, fig. 2; Lambert, *Genus Pinus*, t. 4; Loudon, *Arboretum*, iv., figs. 2081-2084; Forbes, *Pinet. Woburn.*, 23; Loudon, *Encycl. of Trees*, figs. 1768, 1769; Antoine, *Conif.*, t. 2, figs. 1, 2; De Chambray, *Traité Prat. Arb. Rés. Conif.*, pl. iii., figs. 12, 13, et pl. v., figs. 6, 7.

Specific Character.—*P. foliis geminis longis erectis; strobilis subsessilibus ovoideo-conicis, squamarum apophysi nitida convexa, carina transversa elevata, latere superiore convexo, umbone rhombeo mutico vel subspinoso.*

Habitat in Corsica et Italia, in Apenninis et Calabria in Sicilia, in Asia Minore et forsan in Græcia.

A tree reaching upwards of 100 feet in height. Trustworthy accounts say that in Corsica it has even reached 180 feet in height and 10 feet in diameter; but these, of course, are unusually large specimens, real giants in their tribe. It is acutely pyramidal in shape, and, when growing alone, well clothed with leaves and branches; trunk straight, bark on the older parts of the tree rugged, thick, and leaden grey in colour; on the young shoots, pale fawn-coloured. The alburnum whitish, and unusually thick, the heart-wood slightly reddish. Branches spreading; when old, often bent down, but rising again towards the ends. Branchlets tolerably thick. Buds (fig. 1) not large, from half-an-inch to an inch in length, and quarter of an inch to half-an-inch in diameter, ovate at the base, peaked and drawn to a point towards the apex, like a camel-hair paint-brush, with a good deal of whitish resin about them. Leaves (shewn in fig. 1) in twos, clustered pretty closely together, and often rather mixed and dishevelled, rather long (from 4 to 6 inches), stiff, often slightly waved, of a rich dark green, with the margins serrulated, and the apex rather obtuse, with about 8 rows of stomata on the back (fig. 2), and about 6 rows on each side on the face. The sheaths of the young leaves are rather long and whitish; when they are older they become brown and blackish. Male catkins, clustered together (fig. 3), elongate in form, and about an inch and a half in length. Anthers (fig. 4) pale yellow, the filament and loculi not very long, but with a large rounded crest (fig. 5), the margin of which

NOTE.—The following list of synonyms and arrangement of the varieties is from Parlature's monograph in De Candolle's "Prodromus."

"PINUS LARICIO Poiret, = *P. Laricio*, var. *α*, *Poiretiana*, Antoine; *P. Laricio*, var. *β*, *latisquama* Willkomim in Willk. et Lange Prod. Fl. Hispan, i. p. 18.

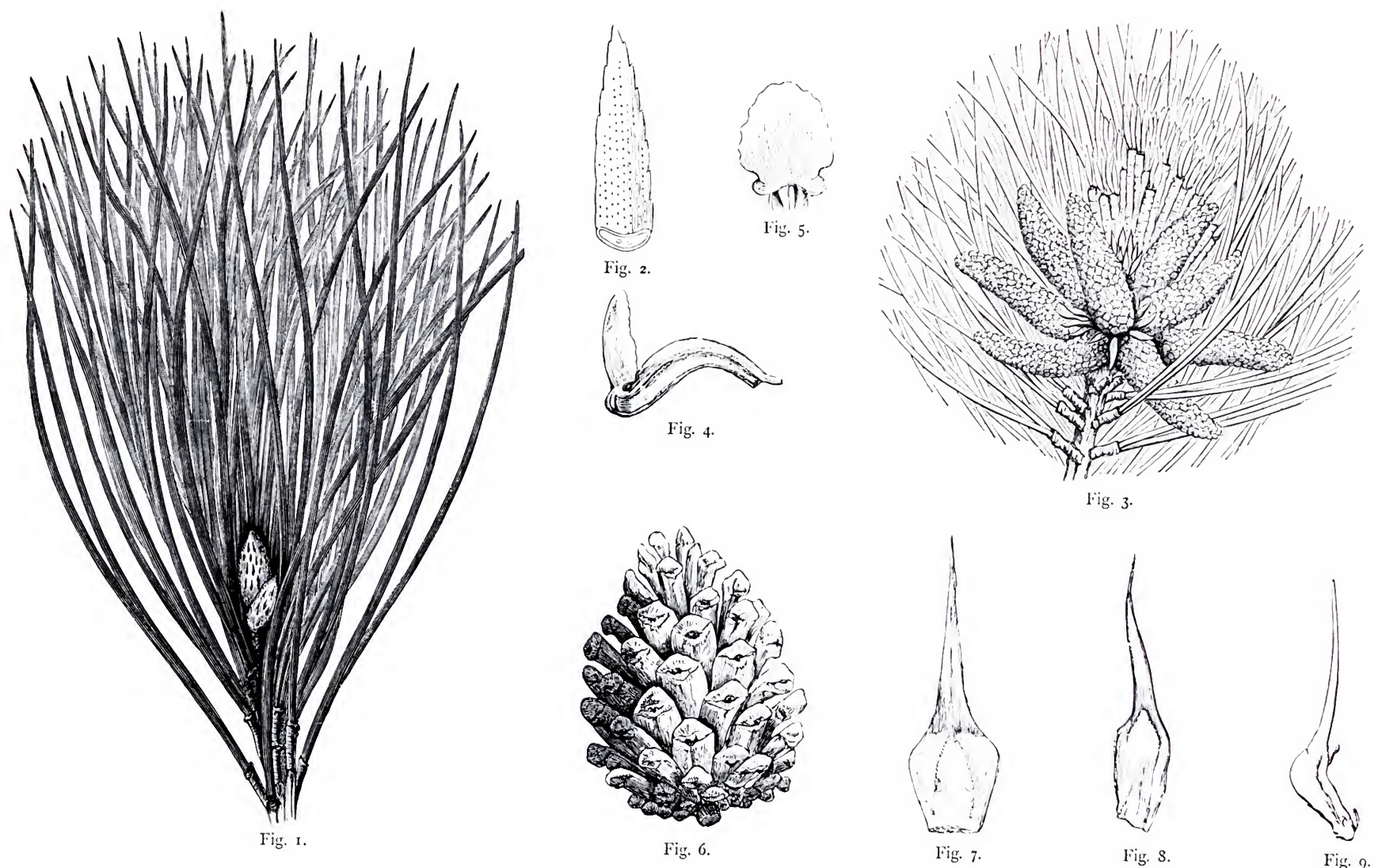
"Var. *β*, TENUIFOLIA, foliis angustioribus et minus rigidis = *P. pyrenaica*, Lapeyrouse, Abrég. Suppt., p. 146, ex parte?; *P. Laricio β pyrenaica* et var. *γ*, *Cebennensis*, Grenier et Godron; *P. mouspeliensis*, Salzmann ined.; *P. Salzmanni*, Dunal in Mem. Acad. Sc. Montpellier, ii. p. 81 cum icon. Carrière, *Conif.*, ed. 2, p. 494; *P. Laricio angustisquama*, Willkomim in Willk. et Lange, l. c.; *P. Laricio leptophylla*, Christ, Europ. Abiet. p. 15, et in Botan. Zeitung, ann. 23, n. 27-29.

"Var. *γ*, NIGRICANS, foliis crassioribus rigidioribus fusco-viridibus = *P. nigricans*, Host. Flor. Austr. ii. p. 268; Link in *Linnaea*, vol. xv. p. 491; Tenore, Flor. Napol. v. p. 266; Bertoloni, Fl. Ital. x. p. 262; *P. austriaca*, Hüss Anleit. p. 6; Monogr. der Schwaze Föhre, Wien, 1831; Carrière, *Conif.*, p. 388; Gordon, *Pinetum*, p. 162; *P. sylvestris*, Baumg. Flor. Transylv. ii. p. 303; *P. Pinaster*, Besser Flor. Galic. ii. p. 294; Tenore, Sylloge, p. 476; *P. Laricio*, Koch, Synops. Fl. Germ. et Helvet, ed. 2, p. 767; *P. Laricio austriaca*, Endlicher, *Conif.*, p. 179; Henk. et Hochstetter, *Nadelholz*, p. 48; *P. Laricio nigricans*, Christ, l. c.; *P. Fenzlii*, Kotschy et Antoine MSS.; Carrière, *Conif.*, p. 496; *P. Heldreichii*, Christ, Europ. Abiet., p. 11; *P. leucodermis*, Antoine in Österr. Bot. Zeitschrift, ann. 1864; *P. Magellensis*, Gussone et Tenore, pl. exsicc.; *P. taurica*, hort.; *P. Dalmatica*, Visiani, Flor. Dalmat. i. p. 199.

"Var. *δ*, PALLASIANA, foliis ut in var. *γ* strobilis majoribus, squamarum apophysi sæpe radiatim fissa = *P. maritima*, Pallas, Index Taur.; *P. Pinca*, Hablitz, Taur., p. 97; *P. halepensis*, M. a Bieberstein, Flor. Taur. Caucas., ii. p. 408; *P. Laricio*, ejusdem Suppl. iii. p. 623; *P. Pallasiana*, Lambert, *Pinus*, ed. ii., p. 11, t. 5, non bona; Carrière, *Conif.*, p. 389; Gordon, *Pinetum*, p. 175; *P. Laricio Pallasiana*, Endlicher, *Conif.*, p. 179."

can scarcely be called lacerated, but only slightly waved or unequal; pollen yellow. The male catkins in all the trees here spoken of, and especially in the Corsican *Laricio*, come to perfection remarkably late as compared with other European Conifers. The catkins of the Corsican or Calabrian *Laricio* generally shed their pollen only at the end of May or beginning of June. The *Laricio Pyrenaica* is a week or ten days earlier, and *nigricans* alias *austriaca* and *Pallasiana* fully two weeks earlier. Cones (see plate) sometimes solitary, at others in twos or threes, sessile, growing on last year's shoots, varying in size from 2 to 3 inches in length, and a little more than one inch in diameter, convex on the one side, and straight or slightly bent in on the other; their colour when young is green, when mature tawny, and purple on that part of the scale which is not exposed to the light until the cone opens (fig. 6); their scales (figs. 7, 8, and 9) have their apophysis raised and shining, slightly thickened, with the outline of the upper margin round, keeled transversely, the keel often bisinuate, sharp, and terminating in a central mucro, which has a very small prickle often rubbed off. Seeds greyish or black, twice as large as those of the Scotch Fir, the wing long (see plate), slender, straight on the back, and gently rounded on the other margin. Germinal leaves six to eight in number.

The leaf-structure of *P. Laricio* as seen in cross sections is as follows: first, the epidermis, next a



double layer of hypoderm-cells, surrounding the central cellular tissue of the leaf. This latter is traversed in the centre by a double fibro-vascular bundle surrounded by a "bundle-sheath." Between the central bundle and the marginal hypoderm are a variable number of resin canals, each one surrounded by "strengthening cells." We have ascertained that the same structure occurs in the forms grown at Kew (1883) under the names of *austriaca*, *Fenzlii*, *Caramanica*, *Pallasiana*, *pygmaea*, *neglecta*, and *Heldreichii*, so that the leaf-structure affords no help in this case in the discrimination of allied forms.

It is a question of difficulty whether *Pinus Laricio*, *P. Laricio* var. *Pyrenaica*, *P. austriaca*, *P. Calabrica*, and *P. Pallasiana* should not all be treated as mere climatal varieties of one species. That they are all of the same type cannot be disputed, and there can be as little doubt that they are all originally offshoots from the same species; more than that, it is not difficult to find examples of each of them, having more or less of the characters of the others; but in the mass, with the exception perhaps of *P. austriaca* and *P. Pallasiana*, which are closer together than the others, the difference between them is sufficiently recognisable,

is

is propagated constantly to their descendants, and is of some practical value. We, therefore, consider that they may be regarded as at least sub-species. The principle which induces us to treat the Deodar (see *infra*) as distinct from the Cedar, applies also here.

The differences by which characteristic specimens of these forms may be distinguished from each other, are the following: Taking the normal *P. Laricio* as the type of the whole of the *Laricio* forms, then *P. L.* var. *Pyrenaica* may be said to be an offshoot in one direction, having the leaves longer and more slender, and somewhat falling back, while *P. austriaca* (including *Pallasiana*) is an offshoot in another, having the leaves shorter and more rigid, more numerous, and of a darker green, and standing bristling straight out. The cone of *Laricio* is generally smaller and less tumid than *austriaca*, while that of *Pallasiana* is larger, longer, straighter, and more like the *Pinaster* than *austriaca*. The prickle on the scales of the cone is stronger and more persistent in *Pallasiana* and *austriaca* than in the Corsican *Laricio* and Pyrenean variety.

The habit and form of the trees is another character by which to distinguish them. The branches as well as the leaves of *P. austriaca* are much more numerous and upright-growing, so that it makes a narrower and closer tree than *Laricio* proper. *Pallasiana*, again, is a still broader-growing tree, the branches springing from near the ground, and spreading out so as to give it the appearance of a broad compact pyramid. The variety *Pyrenaica*, on the other hand, when growing alone is more like *Laricio*; although in its native mountains it is bare until near the top, leaving only a tufted summit somewhat in the fashion of *P. Pinea*—a character probably due to their having been crowded in their youth.

The variety which grows in Calabria, *Pinus Calabrica*, is more cylindrically conic, its branches more upright, and, as it were, adpressed to the stem, forming a narrower and more compact head, looking, in general, more like a *Cembra*. In plantations of this variety there are usually a great number of trees with two or more leaders. This may be due to the more upright direction of the branches above alluded to. This variety was named *Calabrica* by Tenore, and *stricta* by Carrière and other horticulturists. M. Carrière doubts whether it may not in fact be a distinct species. "This form, perhaps indeed this species," says he, "is very constant in its reproduction, and among the individuals of which I have spoken, none has wandered from the characters above mentioned." But we find Professor Schouw observing no such difference; he says (*Annal. Sc. Nat., loc. cit.*), "The variety called *Calabrica* by Tenore, of which I obtained specimens from the Botanic Garden at Naples, perfectly corresponds with Duhamel's figure, and with the great tree of this species (*Laricio*) in the Garden of Plants, at Paris." *Pinus Heldreichii* and *Pinus Fenzlii*, Antoine and Kotschy, are synonyms of a variety of *Calabrica*.

There is another tree, however, which Endlicher and all subsequent writers have agreed in ranking as a variety of *Laricio*, but the identity of which, with it, seems to us more questionable—viz., a shrubby alpine form, which Schouw found on the highest region of Mount Amaro, the loftiest peak of the Majella (a part of the Apennines in Abruzzo Citeriore, in the latitude of Rome, but on the Adriatic side of Italy). He described it provisionally under the name of *Pinus Magellensis*. It appeared to him to be different from the Alpine *Pumilio*, and to be either an Alpine form of *Laricio*, or rather a species bearing the same relation to that species that *P. Pumilio* does to *P. sylvestris*. Like *Pumilio* it has its branches curved down, and lying flat upon the ground, with stiff, slightly curved, serrated leaves; its cone is spherical, and still smaller than that of *Pumilio*; three leaves are, moreover, often found in the sheath; a thing which sometimes occurs in *Laricio*, but that is a circumstance of variation to which we do not attach any value; and lastly, it differs from *P. Pumilio* in having the integuments of its leaf-buds very large, membranous, black at the base, and remaining some time after the leaves are developed. In that it is more like *Laricio*; but then the leaf-bud is not pencil-shaped as in *Laricio*: on the contrary, it is very obtuse, which makes it difficult to refer it to that species. At the same time, Schouw mentions that he had received a specimen of *Laricio* from the same mountain (Valle del Ofrenta), given him by Gussone, which had cones smaller than usual, and short, stiff, slightly curved leaves. He found another shrubby Pine (without cones) on the top of Mount Pollino, in Calabria, which he was in doubt whether to refer to *P. Pumilio* or his *P. Magellensis*. The two would thus appear to be very close, which rather throws doubt on the latter belonging to *Laricio*.

Geographical

Geographical Distribution.—Like the Pinaster and the Cephalonian Silver Firs, the *Laricio* type stretches in a band across the south of Europe; more modified by condition than the Pinaster, the local varieties of which are not sufficiently marked to warrant separation from the normal form; and modified to a less extent, perhaps, than the Cephalonian Silver Firs, which in Spain are represented by *Picea Pinsapo*, and in Greece by *P. Apollinis*. The *Laricio* assumes the varietal form of *Pinus Pyrenaica* in the Pyrenees, of the typical *Laricio* in Corsica, Calabria, Sicily, Greece (?), and Asia Minor (?), of *nigricans* or *austriaca* in Austria, and of *Pallasiana* in the Crimea.

The limits of the *Laricio* proper appear to be Corsica, the Apennines in Italy, and Calabria generally, and Mount Etna in Sicily, at an elevation of 4000 to 6000 feet. Grisebach gives it as found on Mount Athos, and it is said by Webb to occur on Mount Serrat, in Spain. Pierre de Tchihatcheff met with it on the Mount Topgedik, in the north of Cilicia Trachea, at 2000 metres; on the northern slope of Boulgar-dagh, at 3000 metres; in the valley of the Aledag in Galatia, at 1700 metres; on the Buchalan-dagh (in the Pont), between Ladik and Amazia, at 1200 metres; and near the village of Baoulo in Pisidia, at 1104 metres. According to M. Grisebach, the upper limit of the *Pinus Laricio* is on Mount Athos, at 1461 metres, and on the Olympus, at 1495 metres.—(*Tchihatcheff*, "Asie Mineure," ii., 306.)

As to all these habitats in Greece and Asia Minor, we still require to know whether the authors speak of *Laricio* in its larger sense as including *Pyrenaica*, *austriaca*, and *Pallasiana*, or in its more restricted sense as only meaning the Corsican form.

Schouw's *Magellensis*, according to the observations of that botanist, begins to appear on Mount Amaro, at the upper limit of the Beech, 5600 feet, and is found nearly as high up as the top of the mountain, 8300 feet: it there essentially contributes to form a region of shrubs. The Dwarf Pine from Mount Pollino extends over a less area between the Sierra di Dolcedorme and Mount Pollino, properly so called, at the height of about 6200 feet.

History.—This species was not distinguished in Europe until about the middle of last century. It was observed, but it was supposed by some to be a variety of the *Pinus Pinaster*, and by others to be a variety of the Scotch Fir, *Pinus sylvestris*; but as it was seen to attain a height never reached by the Scotch Fir, it was distinguished by the name of *Pinus sylvestris altissima*. That name *altissima*, although supplanted by *Laricio* more than eighty years ago, is still to be found in some old collections and nurseries, either given as a distinct species of that name, or as *Pinus Laricio altissima*, as if it were a tall-growing variety of *Pinus Laricio*; whereas, in fact, the tall-growing epithet was originally only applied, and only applicable to its growth, when contrasted with that of *Pinus sylvestris*.

It was introduced into England in 1759 under the name *Pinus sylvestris maritima*, and that name was adopted by Aiton in the first edition of his "Hortus Kewensis"—shortened or promoted into *Pinus maritima* in his second edition. It was not, however, until after Don had drawn attention to it in the Appendix to Dr. Neill's "Horticultural Tour through France and the Netherlands," that it began to be introduced in some quantity into England. In France it appears first to have attracted the notice of Government, under Turgot's Ministry, in the time of Louis XVI., and the fine tree in the Jardin des Plantes, which was figured in the "Nouveau Duhamel," was planted in 1774. It appears to have been then used in shipbuilding, for beams, flooring, and side planks of ships, but not for masts until 1788. In that year the French Administration of the Marine sent two engineers to examine the forests of Lonca and Rospa in Corsica, and they found plenty of trees fit for masts, only they required to be made thicker than usual, to make up for the inferior strength and elasticity of the timber. The French Government appear to have always highly appreciated this tree. In 1814 they appointed M. Thouin to draw up directions for its growth and management, so as to stimulate its introduction and cultivation. He published an account of the tree and its value for economic purposes. Notwithstanding this, and the well-known fact that abundance of seed might have been procured from Corsica, had there been any demand for it, no sufficient supply appears to have been obtained even for the Royal forests; for M. Larminat was obliged to have recourse

PINUS LARICIO

5

recourse to grafting to obtain the supply he wanted for the Forest of Fontainebleau, and many thousands of the trees there were then grafted on the Scotch Fir. Since then, however, MM. Vilmorin-Andrieux of Paris, who strongly recommended its cultivation, have been the means of supplying all the principal seedsmen in Europe with seed, and it has come largely into favour: seeds are cheap and plentiful, and it is becoming extensively cultivated throughout Britain and on the Continent.

As with other Pines, there are plenty of varieties which have been dignified with names by nurserymen, such as *contorta*, *pendula*, *variegata*, *subviridis*, *nana*, *pygmæa*, *stricta*, *pyramidata*, &c. These, however, do not concern us any more, at least, than to know that here, as in all species, there are individual idiosyncrasies which are interesting botanically and from the point of view of variety, and which can be detected by those who are on the outlook for them, and propagated by grafting or otherwise.

Properties and Uses.—The most valuable of these are hardiness, rapid growth, and good timber. On reference to Mr. Palmer's tables of the worst effects of the winter of 1860–61, we find that the tree is, if not absolutely invulnerable, at least as hardy as the Scotch Fir; and as to rapidity of growth, it is found considerably to outstrip it. At Belstane, on the north side of the Pentlands, near Edinburgh, at an elevation of between 700 and 900 feet above the sea, and a spot which may be taken as subjected to a tolerably severe climate, "this species and its varieties are in the most flourishing condition, overtopping Larches and Spruces planted at the same time." Another most valuable property in such a game-preserving country as Britain, is, that it is rarely, if ever, touched by hares and rabbits.

Its uses are those to which the best-timbered Conifers are put. M. Thouin says that its wood is heavier than that of *Pinus sylvestris* from Riga, but, being more resinous, it is less brittle and more elastic. We scarcely think that these are the properties produced by a greater amount of resin. A greater amount of resin will make the wood harder and heavier, but it ought not to make it more elastic or less brittle. Speaking from theory, we should say the reverse; nor does further experience discountenance theory. The Pinaster, in its native country, has more resin than the Scotch Fir, and it is not less brittle and more elastic, but the contrary; and so it turns out to be with the *Laricio*. M. Thouin's premisses are erroneous—the *Laricio* timber is very good, but it is not equal to that of the Scotch Fir, and, in particular, it is inferior in tenacity and elasticity. Like all very resinous timber, however, its heart-wood, which is largely charged with resin, is exceedingly durable. The sap-wood is thicker than in most other Conifers. It is consequently easily worked, and is used by sculptors and cabinet-makers. It is also used occasionally in some of its native forests for making turpentine.

Messrs. Henkel and Hochstetter (*supra cit.*) mention, that in the London International Exhibition of 1862, there was a stem from the south of France which was 125 years old, and which had been made use of for extracting turpentine for 96 years. They mention this under the head of *Pinus Laricio*, but we imagine it must rather be the *P. Pinaster*, which is more generally used for that purpose.

The timber of this tree is likely to prove of great value in Britain. It comes next after the Scotch Fir in utility, and its inferiority in some points is counterbalanced by its more rapid growth and greater size.

"As a fast-growing ornamental tree, or for planting in exposed or maritime situations, the Corsican Pine (says Mr. A. D. Webster in the *Gardeners' Chronicle*, December 15, 1883) bids fair to outrival all others, not even excepting the much-praised Austrian and Pinaster, and to which, more especially as regards quality of wood, it is in every way superior." The average height of a large number of specimens planted at Penrhyn, N. Wales, soon after the introduction to this country, is now (1883) from 50 to 60 feet, the stems at breast height girthing about 5 feet. One specimen on the lawn to the south-west of the castle has the following dimensions: Height, 72 feet, girth of stem at 1 and at 5 feet, 9½ feet and 9½ feet respectively. Mr. Webster says it is premature to say much as to the value of the timber, but so far he finds it very satisfactory, like red deal, but more brittle and with much resin.

Culture.—The *Pinus Laricio* is perfectly hardy. Mr. Palmer's tables shew, out of 49 places reported

PINETUM BRITANNICUM

on, only one place where it was killed, and one where it was injured during the winter of 1860-61, the former being at Cambridge, and the latter at Aldenham Abbey, Hertfordshire. Several of the localities were in the coldest parts of Scotland, and there none were injured: the tree in this respect escaping better even than the Scotch Fir. The variety *Calabrica* was reported on from 13 places, and at not one was it hurt. It is beyond doubt hardy in every part of Britain. In the nursery the tree requires to be frequently transplanted before it is planted out permanently.

The following list contains the heights, ages, and date of measurement of some of the finest *Laricios* in the United Kingdom:

County.	Place.	Height.	Age.	Date.	County.	Place.	Height.	Age.	Date.
ENGLAND AND WALES.					ENGLAND.				
Bedfordshire	Woburn Abbey	50	30	1862	Nottinghamshire ...	Welbeck Abbey	30	20	1862
Cornwall	Bownnoe	44	19	1862	Staffordshire	Biddulph Grange	30	...	1860
Cornwall	Tchidy Park	35	35	1862	Surrey	Kew	90	...	1867
Cornwall	Penrose	33	30	1862	Surrey	Oakham Park, Ripley	71	42	1867
Derbyshire	Coed Coch	36	20	1862	Yorkshire	Sprotbro Hall	56	...	1862
Derbyshire	Elvaston	50	29	1862	SCOTLAND.				
Derbyshire	Sudbury Hall	36	30	1864	Argyle	Stonefield	32	19	1862
Derbyshire	Derby Arboretum	30	24	1862	Dumbarton	Ross Dhu	35	26	1862
Devonshire	Endleigh	60	50	1863	Mid-Lothian	Riccarton	44	32	1862
Devonshire	Woodovis	55	35	1862	Peebles	Dalwick	42	32	1862
Devonshire	Bicton	50	30	1862	Perthshire	Murthly Castle	45	?	1862
Gloucestershire	Highnam Court	32	15	1863	Perthshire	Taymouth Castle	33	22	1862
Herefordshire	Eastnor Castle	30	20	1862	Perthshire	Balgowan	32	30	1862
Isle of Wight	Osborne	30	20	1862	Perthshire	Keillour	30	31	1863
Kent	Redleaf	50	20	1862	IRELAND.				
Lancashire	Calderstone	50	30	1862	Cork	Castle Martyr	47	22	1862
Lancashire	Cuerden Hall	43	27	1864	Tyrone	Caledon Hill	35	25	1862
Lancashire	Cuerden Hall	37	26	1864	Tyrone	Cecil	32	25	1862
Lincolnshire	Sudbrooke Holme	40	...	1860					
Lincolnshire	Bloxholm Hall	40	20	1862					
Norfolk	Holkham	60	50	1862					

On the Continent specimens of large size are to be met with. That in the Jardin des Plantes is a true Corsican *Laricio*, planted by Ant. L. de Jussieu and André Thouin about 1774. It was accurately measured in 1861, when, as we are informed by M. Henri Vilmorin, "it was 25.70 metres (82 ft.) in height; but from that time until the present date (1883) it does not appear to have grown much. It suffered greatly in the terribly cold winter of 1879-80. It has thirty-three verticils, and the branches are nearly horizontal, while its general contour is pyramidal. The girth at the ground is 3.60 metres, and at 1 metre above the ground 2.66 metres. The circumference of the head is 33 metres." A well-known specimen at Fromont is the Calabrian variety, which is about 82 feet high. At M. Vilmorin's estate at Barres, near Nogent-sur-Vernisson, the Calabrian and Corsican types have been grown for comparison, the soil and other conditions being equal. M. Vilmorin tells us that "a line of specimens of each kind were planted about sixty years ago, the distances between the lines being from 5 to 6 metres. As regards height the two kinds are nearly equal, viz., from 20 to 22 metres, but the Corsican has more prostrate branches as compared with the Calabrian, the branches in the former being nearly horizontal. The Calabrian is now (1883) 65 centimetres in diameter, while the Corsican is only 50 centimetres. The difference is about the same as that between the *Pinus sylvestris* of Riga and that of Hagenau."

M. Carrière mentions the following places in France as having good specimens of the *Laricio*, var. *stricta*: Harcourt (Calvados), in the grounds of the Society of Agriculture; at Barres; and at Ris (Seine et Oise), in the Garden of Fromont.

Commercial Statistics.—In 1853 the price per 1000 of 1 year seedlings, 4s., and once transplanted, 12s.; 2 year seedlings, 7s., and twice transplanted, 21s. per 1000; young plants, 15 inches, 1s. each. In 1863, 1 year seedlings, 3s. 6d., and once transplanted, 11s., young plants, 9 to 12 inches, 40s. per 1000; in 1873 1 year seedlings, 3s., and once transplanted, 10s. 6d., 9 to 12 inches, 35s. per 1000; in 1883 1 year seedlings, 3s. 6d., 2 year do. 5s., 1 year and once transplanted, 7s. 6d., 9 to 12 inches, 21s. per 1000; specimen plants, 18 inches to 2 feet, 6d., 3 to 5 feet, 2s., 7 to 8 feet, 5s. to 7s. 6d. each. Price of seeds in 1863, 5s. 6d. per lb.; in 1873, 4s. 6d.; and in 1883, 3s. 6d. per lb.

PINUS MANDSHURICA.

SLANEZ of the Ruffians; BOLGIKDA of the Tungusians; BOLGYTT of the Lamutans; SUTUM or SCHOTOM of the Kamtschatdales;
KATSCHIVOK of the Koraeks; PAXEPNI of the Kurile Tribes; KOLDONG of the Chodzea Tribes; GUA-SUNG of the Chinese.

IDENTIFICATION.—PINUS FOLIIS QUINIS, CONO ERECTO, NUCLEO EDULI, PUMILA NUCLEIS MINORIBUS, Gmelin.
Flora Siber., i. 179 (1747).

PINUS CEMBRA B. PUMILA, Pallas, *Flor. Ross.*, i. p. 5 (1784.)

PINUS PYGMÆA, (Fischer MSS.)

PINUS CEMBRA, VAR. PYGMÆA, Loudon, *Arboretum*, iv. b. 2274 (1838); *Loudon Encycl. of Trees*, p. 1016 (1842).

PINUS CEMBRA, VAR. PUMILA, Endlicher, *Synopsis Conifer.*, p. 142 (1847); Lindley and Gordon, *Journ. Hort. Soc.*,
v. p. 214 (1850); Lawson, *Abietineæ*, p. 24 (1851). Carrière, *Traité Gén. des Conif.*, p. 296 (1855).

PINUS CEMBRA PYGMÆA, Gordon, *Pinctum*, 220 (1855), and *Supplement*, p. 68 (1862).

PINUS MANDSHURICA, Regel, *Tentamen. Flor. Uffur.*

Specific Character.—Cembra trunco fruticoso humili, ramis elongatis prostratis decumbentibus vel adscendentibus, foliis brevioribus marginibus haud ferrulatis fasciculis magis confertis; strobilis parvis subcylindricis, apophysi parum reflexo; feminibus parvis.

Habitat in Siberia ultra Lenam, in Kamtschatka, et in Insulis Kurilibus.

This species has generally (but erroneously) been considered a climatal variety of *P. Cembra*. Although perfectly distinct from that Pine, it is so closely allied to it that we shall best describe it by contrasting their characters, and pointing out where they agree and where they differ.

The true *P. Cembra* is a lofty tree, reaching a height of 100 or even 120 feet, and with a trunk attaining a circumference of from 12 to 18 feet. The present species is always a stunted bush, and never reaches the dimensions or the habit of a tree. The trunk, according to Pallas, does not exceed two inches in thickness, and the branches rarely more than one inch. The tree in Siberia does not exceed six feet in height; in Britain it does not get much beyond six inches. It is stunted in its native desolate country, and continues so when cultivated in more genial climes; and this not only when young, but when it has attained such maturity as to produce cones. Its branches are tortuous. The young bark is rich brown, corrugated, and marked with the scars of fallen leaves; when older it becomes blackish. The leaves [fig. 1] are finer and shorter in *P. Mandshurica* than in *P. Cembra*, often only about an inch, and seldom exceeding two inches in length, while the other reaches three inches, and they are clustered more closely in tufts or fascicles; but the most marked distinction in the leaves is that, in *P. Cembra*, the margins are strongly ferrulated, while in *P. Mandshurica* there are no serrations at all, the margins being perfectly smooth. The stomata in *P. Cembra* are usually in from three to five rows; in *P. Mandshurica* they are sometimes in two, and sometimes



Fig. 1.

PINUS MANDSHURICA.

3

Siadadyngya, Salalé, Dahaang-dyngza, &c. We are, however, still in the dark as to the limits of its distribution in other parts of Eastern Siberia.

History.—Until Professor Regel pointed out the specific distinction that the margins of its leaves are not ferrulated, while those of *P. Cembra* are, this species was reckoned by botanists to be only a variety of *P. Cembra*. It had been noticed by Gmelin upwards of 120 years ago; and Pallas in 1784 gave it the sub-specific name of *P. Cembra, var. pumila*.

Endlicher, in his "Synopsis Coniferarum," suggests that this form, as he considered it, of *P. Cembra* should be compared by the student with *P. Koraiensis*:—"Forma B. propria ut videtur species cum Pinu Koraiensi Sieb. Zucc. studiosius comparanda." The suggestion is doubtless given on the strength of the locality. He may have thought it not improbable that a *Cembra* found in Japan might very probably prove identical with one which was common on the adjoining mainland; but the idea is erroneous. It is probably from this remark of Endlicher's that an opinion, which we have heard expressed, has originated, that the young plants of *P. Koraiensis*, introduced from Japan, were only a variety of *P. Cembra, var. pumila*; in other words, of this species. But they do not even belong to the same section of the Cembroid Pines as the true *P. Cembra*. The scales and cone of *P. Koraiensis* are larger, longer, and thinner in texture (instead of being smaller and shorter, and thick and solid), than those of the true *P. Cembra*. It has more the character of the Mexican *P. Don Pedri*—a subsection of the Cembroid Pines characteristic of Mexico, in the same way that the *Pseudo-strobi* there represent the true *Strobi*. If we must seek for an ally to it in Japan, it is to *P. parviflora* that we should look. That species comes nearer to the true Cembras than any other Japanese Pine, but is separated from them *longo intervallo*. *P. parviflora* (although a *Cembra*) has short scales to its large seeds, shewing the futility of all attempts to restrict within absolute and fixed boundaries any genera, or other subdivision or group of species, which man may seek to establish.

Properties.—Much practical advantage is not to be expected from the cultivation of a tree which, in this country, after fifty years' growth, has only reached eight inches in height. Even in its native country, a height of five feet and a diameter of two inches will not suit many purposes. Pallas, however, mentions that the young shoots are reckoned an excellent antiscorbutic, and are much more agreeable to the taste than those of the fir.

Culture.—So far as we know, this species has not been introduced of late years into this country, either under the name of *P. Cembra, var. pumila*, or *P. Mandshurica*; and a single plant at Dropmore is, we believe, the only specimen in Britain. Through the kindness of Professor Regel, we have received a few seeds, which we trust will, in another year, render this remark no longer applicable. Loudon speaks of the one at Dropmore, and it is also noticed by Carrière, and both referred it to either this species, or to the pigmy horticultural variety of the common *Cembra*. We have examined it, and find that it possesses the unferrulated leaves and bifacial stomata of this species, to which we therefore refer it without doubt. When Loudon saw it in 1837, it had been twenty years planted, and yet was only six inches high. It is now (1866) only eight and a half inches high; and Mr Frost informs us that he has remembered it over forty years, and does not see much difference in its size from the time he first knew it. Loudon also speaks of one in the garden at Hopetoun House, near Edinburgh, which was then (1836) said to be upwards of 100 years old, and measuring five feet six inches high. There is some doubt as to the identity of this individual, a pigmy *P. Strobis* having apparently become confounded with it; but at any rate, whatever may be the true individual, there is now none to be found there possessing the distinctive characters of this species, such as the unferrulated leaves, &c. Pallas mentions that he had a specimen from Montanvert, in Savoy, which resembled the Siberian variety in the closeness of the leaves, only they were much thicker. This was, doubtless, merely a variety of the common Swiss *P. Cembra*.

Several recent *envois* of seeds of this species have been received in Russia, through the different exploring expeditions of Middendorf, Radde, Schrenck, Maack, and Maximowicz, which have latterly made us acquainted with much of the natural history of Eastern Siberia; and we understand that it grows well in the Botanic Garden at St Petersburg, and there maintains its distinctive character.

It is an addition to the hardy Pines that thrive in Britain, which is interesting to the botanist and student of geographical distribution; but in other respects it can scarcely be called a valuable acquisition.

Commercial Statistics.—None, never having been in the market.



Jas Black, Del.

Jas Black, Fer.

PINUS FREMONTIANA. Endlicher.

Printed from Zinc by W & A K Johnston Edinburgh

PINUS MONOPHYLLA

(P. FREMONTIANA).

IDENTIFICATION.—PINUS MONOPHYLLA, Torrey, in *Report in Fremont's Exploring Expedition to the Rocky Mountains in 1842, and to Oregon and California in 1843*, p. 319 (1845).

PINUS FREMONTIANA, Endlicher, *Syn. Conif.*, p. 183 (1847); Gordon, in *Journ. Hort. Soc.* (exclus. Syn. Endlicher and Torrey), iv. p. 293 (1849); Knight, *Syn. Conif.*, p. 28 (1850); Lindley and Gordon, *Hort. Soc. Journ.*, v. p. 216 (1850); Carrière, *Traité Gén. des Conif.*, p. 406 (1855); Gordon, *Pinetum*, p. 194 (1858); Henkell and Hochstetter, *Synop. de Nadelholzer*, p. 91 (1865).

ENGRAVINGS.—*Cone and Leaves*.—Torrey, in *Bot. Fremont's Rep.*, t. 4; Gordon, in *Journ. Hort. Soc.*, iv. p. 293.

Specific Character.—Pinus foliis solitariis abbreviatis rigidis pungentibus, strobilis brevibus squamis prominentibus, utrinque lato excavato apophysi pyramidata recurva, umbone truncato, seminibus apteris.

Habitat in California boreali montibus, inter 111° - 120° long. W.

A small tree, rarely exceeding 20 feet in height and 1 foot in diameter. Branches verticillate. Bark pale brown, with the marks of the insertion of the leaves distinct, especially on the young plants [fig. 1]. Buds cylindrical clavate: Dr Torrey says they are about $\frac{3}{4}$ of an inch in length; but those we have seen are only about $\frac{1}{4}$ of an inch in length. Leaves [fig. 2] solitary, occasionally two in a sheath, but not agglutinated together, as is erroneously stated by Endlicher to be the case. They are from 1 inch to $2\frac{1}{2}$ inches in length, with about fourteen longitudinal rows of oblong stomata [fig. 3]; often more or less curved, very stout and stiff, round and longitudinally corrugated, in herbarium specimens tapering, and ending in a spiny point.

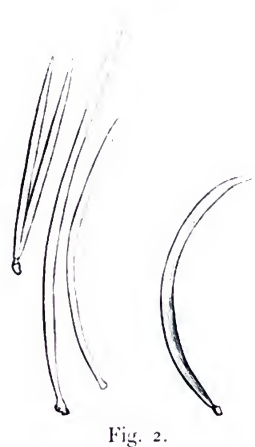


Fig. 2.



Fig. 3.

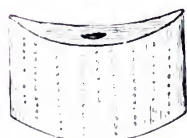


Fig. 4.

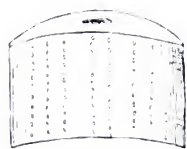


Fig. 5.



Fig. 6.
(Copied from Torrey's figure.)



Fig. 7.

In the rare case of there being two in the sheath they are semi-cylindrical, and each has about seven or eight longitudinal rows of stomata on the back, and five to seven on the inner side [figs. 4 and 5]; the stomata are large and oblong, and the margins of the leaves are entire. The sheaths of the leaves about $\frac{1}{3}$ of an inch in length around the young leaves, but very soon deciduous; pale fawn colour. Male catkins about 1 inch in length [fig. 6]. Stamens with a large rounded crest. Cones ovoid, fawn-coloured, from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches long, and about $1\frac{3}{4}$ inches broad at the broadest part [fig. 7]. Scales with a thick and obtusely pyramidal protuberant apophysis, somewhat recurved; the umbo is slightly depressed and corrugated, but



Fig. 1.
(Copied from Torrey's figure.)

without any spine [figs. 8 and 9]. The seeds [fig. 10] are oblong, pale yellowish, marked with brown, about $\frac{1}{2}$ an inch long; wingless, the wing being indissolubly adherent to the scale. The kernel is of a pleasant flavour, resembling that of *Pinus Cembra*. According to Gordon, the seed-leaves are nine or ten, but mostly nine, in number.

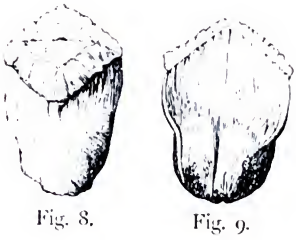


Fig. 8.

Fig. 9.



Fig. 10.

This tree is distinguished from all other Pines with which we are acquainted, by having only one leaf in the sheath. The leaf has all the appearance of being two leaves agglutinated into one, and has thus deceived Endlicher and other botanists, and led them to believe that the species belonged to the two-leaved section. On examining the leaf closer, however, and more especially by cutting it across, we see that a single mid-rib runs up the centre of the leaf like a pith, shewing beyond doubt that it is essentially only one leaf. Loudon in his "Arboretum," iv. p. 2158, describes a variety of *Pinus sylvestris* as having only one leaf, and to which Mr Hodgkins, nurseryman, Dunganstown, near Wicklow, who sent it to the Horticultural Society's garden, gave the name of *monophylla*. This was in 1830. It proved, however, to be only an abnormal or monstrous form of the species, the apparently single leaf being two distinct leaves slightly twisted together, and separating readily when taken between the finger and thumb.

Geographical Distribution.—This tree was found by Fremont extensively spread over the mountains of Northern California, from long. 111° to 120° W., and through a considerable range of latitude. It is the tree alluded to repeatedly by him in the course of his narrative as the Nut Pine.

Dr Torrey, in his remarks on *P. edulis* ("Mexican Boundary Report," ii. p. 208), immediately after speaking of the synonymy of this species, makes one or two observations as to localities where "the tree" is found, which we believe apply to this species, the localities of *P. edulis* being separately given, and not extending farther north than New Mexico. He says: "Colonel Fremont found extensive forests of the tree in his first expedition, as well as in his journey of 1853-54. Dr Bigelow also found it in Whipple's expedition on the mountains of California, but in consequence of an oversight it was not included in the Botanical Report of that expedition."

We have received it from the Sierra Nevada, at about the same latitude as Monterey.

History.—This species was first observed by Colonel Fremont on the Sierra Nevada, in Northern California, during his expedition to Oregon and California in 1843. It was described by Dr Torrey in the "Botanical Report" appended to Colonel Fremont's account of the expedition (published in 1845). His description and figures are clear and characteristic, and should enable any one to distinguish it without difficulty.

Endlicher, two years later, included it in his "Synopsis Coniferarum," but, without giving any reason for it, altered the name from *monophylla* to *Fremontiana*, turning the former into a synonym, and further altered the description from the statement that the leaves are solitary, very rarely in pairs, and terete (except in the very rare case of being in pairs, when they are semi-cylindrical) to the general assertion that the leaves are *in pairs*, semi-cylindric, *very rarely separated*, for the most part coalesced into a single cylindrical leaf ("Folia gemina semi-cylindrica, rarissime discreta, plerumque in folium unicum cylindricum coalita"), an assertion which, as we have above shewn, is erroneous, in so far as it makes the leaves normally in pairs, and semi-cylindric. It seems to us that Endlicher was deceived by the appearance of the leaf, and supposed that, although not actually in twos, it was two leaves glued together; and that when two did appear in the sheath it was merely that the normal two leaves had been liberated from the coalescence. If he had examined the interior of the leaf, and seen that it had only one mid-rib, he would have recognised the error of this supposition. When two leaves appear, it is an ordinary duplication, and their semi-cylindrical, instead of cylindrical, form is merely due to the pressure of the two leaves on each other in the bud while the tissues are soft and impressionable. The normal leaf is single and cylindrical, and shews that that is the natural form of the Pine leaf, however it may be afterwards altered by contiguity to others in the same sheath.

Although

PINUS MONOPHYLLA.

3

Although Endlicher gives no reason for changing the name from *monophylla* to *Fremontiana*, Mr Gordon, who two years later gave a figure and description of the same species, states that the origin of the change was as follows: "Dr Torrey first gave the name of *monophylla* to this Pine from a supposition that the leaves were mostly solitary, but Professor Endlicher, who afterwards examined more perfect specimens, found that the leaves were in twos and threes, and that the solitary leaves arose from Dr Torrey's specimens being gathered from stunted plants. He consequently altered Dr Torrey's name of *monophylla* to that of *Fremontiana*, in compliment to Captain Fremont, its first discoverer."

On this paragraph Dr Torrey afterwards ("Botanical Report in United States and Mexican Boundary Report," vol. ii. p. 208, 1859) remarks—"Gordon, in the work just quoted (*Hort. Soc. Four.*), refers this species to *P. monophylla*, Tor. and Frem., the name of which he says was changed to *P. Fremontiana* by Professor Endlicher ('Syn. Conif.' p. 183) because that botanist 'having afterwards examined more perfect specimens, found that the leaves were in twos and threes, and that the solitary leaves arose from Dr Torrey's specimens being gathered from stunted plants.' Now we find that Endlicher has no remarks of this kind. His entire description is taken from mine in Fremont's Second Report, but he regards what I call a single leaf as consisting of two united leaves."

Still we are inclined to think that Mr Gordon's account is in the main correct. Of course, the statement as to the respective condition of Professor Endlicher's and Dr Torrey's specimens may have been (must have been) a conjecture of his own; but the motive of the change of name assigned by him seems very probable. Whether the above was Endlicher's reason for changing the name or not, it is clear that he was wrong in changing it. Dr Torrey's name, *monophylla*, is sound, well-founded, and most characteristic, and the rules of priority require that it should be restored.

The next notice of the species after Endlicher's is that by Gordon, above referred to, in the *Horticultural Society's Journal*, iv. 293. Seeds and specimens of the cone were sent home by Hartweg, who gives the following information regarding it (*Horticultural Society's Journal*, iii. 226):—"Previous to leaving Monterey, I was told by several persons that a kind of thin-shelled Pine-nut is occasionally brought for sale by the Indians to Santa Inez and Santa Barbara, without being able to learn any more respecting it. Upon making further inquiries at Santa Inez, I was told that the Indians bring them from a great distance, that the harvest of them was over, but that I might procure a few from the mission Indians. Proceeding to a hut which was pointed out to me, I bought a gallon of the fresh seeds, and, inquiring about the size of the cones, the Indian handed me two, with the information that the trees are of a small size, when, judge of my surprise, I recognised in them those of *Pinus Llaveana*, which I had on former occasions found in several parts of Mexico." In this last point he was in error, as we shall presently shew.

Mr Gordon tells us further that the seeds were received by the Horticultural Society, and being in tolerably good condition at the time, soon came up, and a portion was distributed under the name of "*Pinus Llaveana*, with a thin-shelled seed." Hartweg's recognition of the cones as those of *P. Llaveana* had apparently led Dr Lindley and Mr Gordon to take it for granted that it was so, and to distribute it under that name, although their addition, "with a thin-shelled seed," indicated doubt. But after the plants had been distributed, it would appear that it had been ascertained that it was not *Llaveana* but Torrey's species, and the error was rectified in Mr Gordon's description. In that description he states that the leaves are generally in threes, but not unfrequently in pairs, or even solitary. This is a most material difference from Dr Torrey's description, in which they are said to be almost entirely solitary. We may here observe that the native specimens which we ourselves possess entirely correspond with Dr Torrey's; in fact, in our specimens received from California, we have seen no leaves in pairs. It is only in plants reared in this country that we have occasionally met with them; and we have never seen nor heard of any in threes but those mentioned by Mr Gordon. We, therefore, should have liked to know Mr Gordon's grounds for stating that they are in threes. His information could not be got from Hartweg's specimens, for Hartweg expressly says that the seeds came far from where he was (he was at Santa Inez, in the coast-

range,

range, and the seeds probably came from the Sierra Nevada in the interior), and that all that he got was a gallon of seeds and two cones. He does not mention leaves. It is very unlikely that the natives would have them; in fact, if branches had been carried by them, the leaves must have all fallen off. Mr Gordon must, therefore, have got his information on this point elsewhere, possibly from Hartweg's description of *Llaveana*, with which, as already said, that gentleman confounded it. The cones and seeds procured by Hartweg entirely correspond with Dr Torrey's description. Dr Torrey himself thinks that they do not, for he regards the species described by Gordon as the *Pinus edulis* of American authors, saying, "Gordon's figure represents the ordinary state of *P. edulis*." It does not strike us in that light. Not only is the



Fig. 11.

locality where Hartweg got it adverse to such a supposition, but a comparison of Torrey's own figure of the cone and seed (our figures 7, 8, and 9 are copied from his original plate) with Gordon's [fig. 11], shews, we think, that they are the same. The figure of the leaf given by Gordon [fig. 12] corresponds with the two-leaved form of this species, but it would doubtless be taken from the young plants raised from Hartweg's seeds, which were all right.



Fig. 12.

As there is a good deal of confusion about these Mexican and Californian Nut Pines, we reproduce, under their proper heads, every original figure which has been given of any of them; and if the reader will turn to *P. Cembroides*, he will see a copy of Dr Torrey's own figure of the cone of that Nut Pine taken from Sitgreaves's report, and be able to judge for himself whether Gordon's figure, above copied, comes nearer Torrey's *monophylla* or his *edulis* (i.e., *Cembroides*). Dr Torrey may not improbably have been misled by Gordon's statement that the leaves were in threes.

Since Endlicher, all authors have adopted his nomenclature, and the species is generally known as *P. Fremontiana*; and our coloured plate having been finished before we had satisfied ourselves on the above points, has, unfortunately, repeated the common version. It ought to have been inscribed *Pinus monophylla*.

Properties and Uses.—To the Indians of North-West America the seeds of this tree are of the greatest importance. They form their chief food for a great part of the year. Nature has been bountiful to them in giving them so many Pine trees with edible seeds. There are no fewer than seven species known, the seeds of which form an important item in their means of subsistence, viz.: *Pinus Lambertiana*, *P. Ayacahuite*, *P. Loudoniana*, *P. Sabiniana*, *P. flexilis*, *P. Cembroides*, and *P. monophylla*. In Colonel Fremont's Report frequent mention of this Nut Pine occurs. From it and other sources we learn that the Indians gather the cones in autumn, extract the seeds from them, and keep them in their huts, or make large heaps (small stacks) of the cones in the open air under the slight protection of the trees themselves, and have recourse to them for fresh supplies when their indoor stock becomes exhausted. The cones are produced in great abundance, and if the tree should thrive in Europe and produce them equally profusely there, it would prove an excellent addition to our desserts, for which purpose it is much used at the missions in California.

The mountains on which it grows are often covered with snow and subjected to great cold; hence, so far as mere lowness of temperature is concerned, there ought to be nothing in this country to prevent its being perfectly hardy: other conditions may prove unfavourable, but cold should not. It is, however, still rare in Britain, so that we have no great experience of its fitness. Mr Palmer's tables only include reports on nine places, and of these the plants at seven of them escaped uninjured during the winter of 1860-61, and at two they were killed; one of them, however, being exceptional, the plants having been otherwise sickly.

There are no large plants of this species in Britain. It is a slow grower.

Commercial Statistics.—Price of young plants in 1866, from 3s. 6d. to 7s. 6d. each; the same price being obtained in the two years following.

PINUS MONTICOLA.

IDENTIFICATION.—PINUS MONTICOLA, Douglas MSS.; Lambert, *Genus Pinus*, 8vo ed., in the appendix, not paged, following "P. Sabiniana" (1832); Forbes, *Pinet. Woburn.*, p. 81 (1839); Loudon, *Arboretum*, iv., p. 2291 (1838); Antoine, *Conif.*, p. 40, t. 18, f. 3 (1840-46); Loudon, *Encycl. of Trees*, p. 1021 (1842); Endlicher, *Syn. Conif.*, p. 148 (1847); Knight, *Syn. Conif.*, p. 34 (1850); Lindley and Gordon, in *Journ. Hort. Soc.*, v., p. 215 (1850); Lawson, *Abietinæ*, p. 26 (1851); Carrière, *Traité Gén. des Conif.*, p. 304 (1855); Gordon, *Pinetum*, p. 233 (1858); ed. 2, p. 314 (1875); Parlato, in *D. C. Prod.*, xvi., sect. post. p. 405 (1868); Koch, *Dendrologie*, ii., p. 323 (1873); Engelmann in *Watson's Botany of California*, ii., p. 123 (1880); Veitch, *Manual of the Coniferae*, p. 181 (1881).

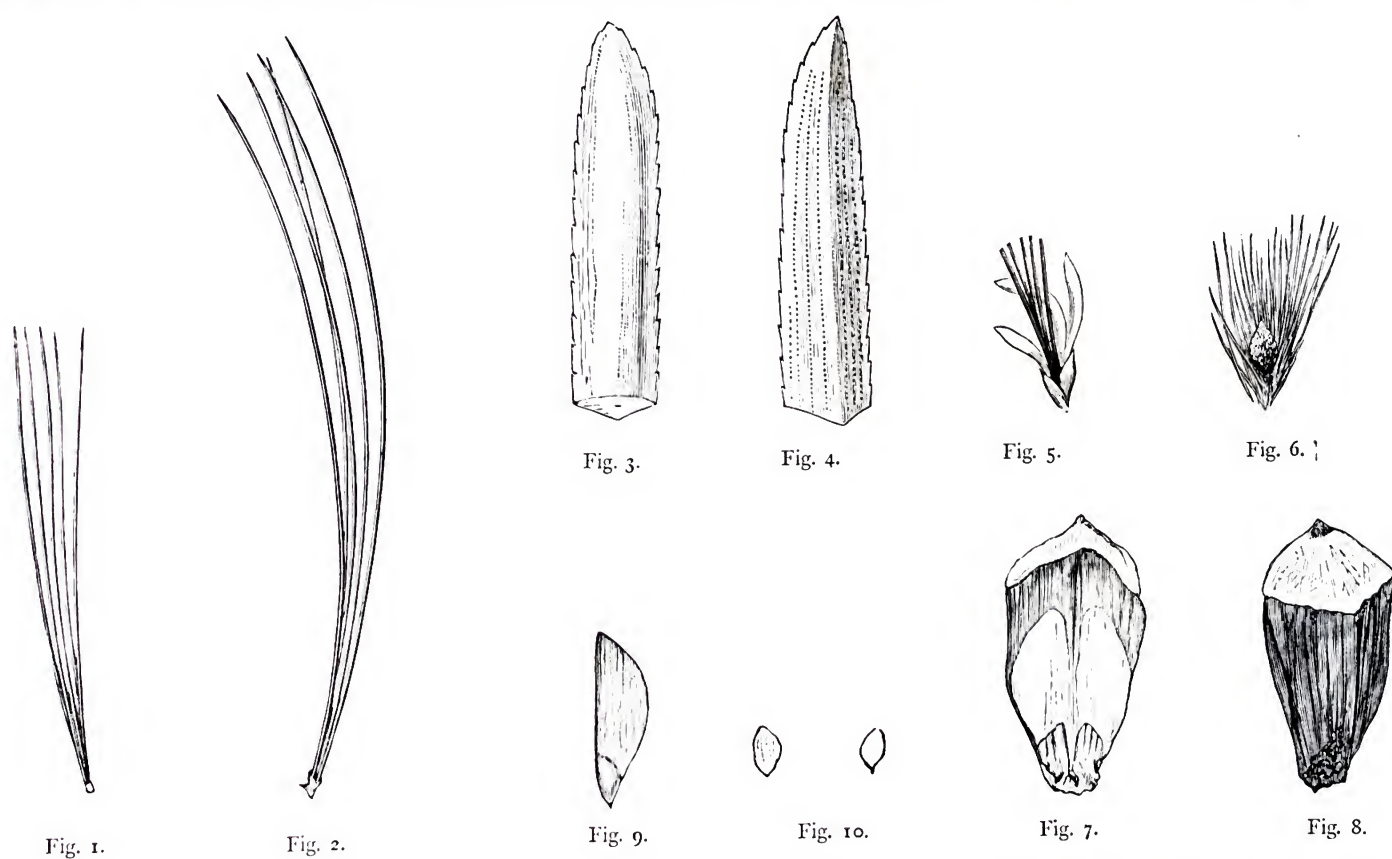
PINUS STROBUS MONTICOLA, Nuttall, *Sylva* (1842).

ENGRAVINGS.—Cones, Leaves, &c.—Forbes, *Pinet. Woburn.*, op. cit., t. 31; Loudon, *Arboretum*, fig. 2208-2209; Loudon, *Encycl. of Trees*, fig. 1913-1914; Antoine, *Conif.*, t. 18; Veitch, loc. cit.

Specific Character.—Pinus foliis quinis; singulis trigonis filiformibus, sat rigidis, dorso sine stomatum seriebus ad facies laterales stomatum seriebus tribus vel quatuor instructis, vaginis caducissimis; strobilis elongatis et acute conicis cylindratis læte castaneis, squamis obtuse pyramidalis, apophysi dimidiato convexo corrugato opaco, umbone terminali acuto; seminibus parvis, alis brunneo-striatis.

Habitat in California et Oregon passim.

A handsome tree, reaching from 60 to 80 feet in height. Bark fuscous, splitting into square plates; young bark, greenish-brown, puberulous. Shoots destitute of leaves at the base. Branches, numerous and close. Leaves (fig. 1) in fives, glaucous green, usually shorter and more rigid than in *P. Strob.*, about 3 inches in length, sometimes longer (fig. 2), rigid, trigonal, with an acute prominent keel, with the margins of the sides serrulated, but with the margin of the keel entire; the back flat, and without stomata (fig. 3), each of the inner sides usually with three or four rows of small whitish stomata (fig. 4). According to Engelmann there is a layer of woody fibres or hypoderm beneath the epidermis (absent in the nearly allied *P. Strob.*), and numerous peripheral resin canals. The sheath very speedily falls off,



so that in general none are to be seen, except when they are young and newly developed; when adherent, it consists of two sizes of scales, the smaller ones at the base consisting of four or five ovate acuminate scales, the others of three or four long transparent scales, becoming ribbon-shaped when worn (fig. 5). Buds small, sharply acuminate (fig. 6). Male catkins small (about $\frac{1}{2}$ inch long), pale, clustered around the stalk, surrounded with broad, bright, fawn-coloured scales. Anthers pale, bilocular, the rounded crest lacinate, ending usually in two projecting points, short, white. Female catkins purple. Cones pale when young,

young, orange-fawn coloured when old, pendent, narrow, elongate, with tears of resin almost always exuding from the exposed part of the scale; from 6 to 8 inches in length, and about an inch in breadth, attenuate towards the apex. Scales (fig. 7 inner side, and fig. 8 outer side), disposed spirally in eight rows; where not exposed brown opaque, the apophysis adpressed, somewhat slightly striated; downy-opaque and orange-fawn coloured; the umbo small, terminal, dark brown, sub-quadrangular acute. Seeds and wing (fig. 9) fawn-coloured, lying in a hollow at the base of the wing, where they are covered by the wing they bear; the wings long and pointed, four times the length of the seed, and marked with blackish-brown waved striæ, most numerous at the apex, so as to be almost entirely dark-brown. The testa of the seed (fig. 10) itself is unspotted.

Description.—Nearly allied to the Weymouth Pine (*P. Strobus*), so much so that Loudon thought this might only prove a variety of it, and consequently only separated them provisionally, “until an opportunity occurs of examining the male catkins, and ascertaining other particulars.” This information we now have, and no doubt exists as to its being a distinct species from *P. Strobus*. The only doubt now is whether two species are not included under the name *P. monticola*. It is a handsomer tree than *P. Strobus*, its green is darker and richer, the leaves are stiffer and less serrulate, while its beautiful orange-coloured cones add to its attractions. It seems less liable to break, and consequently has more rarely double branches or competing leaders than the Weymouth Pine.

Geographical Distribution.—This is a native of North-West America, where it represents the Weymouth Pine of the eastern coast of the Continent. It is found in the high mountains at the Grand Rapids of the Columbia, on the rocky banks of the Spokane river. It also grows in Northern California, about Scots Mountain. It does not occur in any of the botanical lists of the different United States exploring expeditions which crossed the Continent within the United States territory for the purpose of ascertaining the best route for a railroad to the Pacific. This may have been due to the distribution of the tree being local, as these expeditions only crossed the country transversely from east to west, and did not explore it longitudinally from north to south, while the expeditions which have done so found it.

History.—First discovered by Douglas in 1831; since then collected by many explorers. Jeffrey, Murray, Beardsley, Bridges, Lobb, &c., have all aided in introducing it into this country.

Properties and Uses.—We have no experience of the timber of this tree in this country, and not much in its native land. The timber is soft, white, and light, and doubtless, like that of the Weymouth Pine, it will be of use for masts and yards of ships as well as for all ordinary purposes; like it, too, it is probably not a wood possessed of great strength or tenacity.

Culture.—The tree is perfectly hardy, and well suited for this country. Only two instances of trees being killed by the frost during the severe winter of 1860, are recorded in Mr. Palmer’s tables out of thirty-seven reported on, and one of these was otherwise ailing. It likes a good loamy soil, not too dry. It is now widely distributed, and is a very general favourite, so that fine specimens are to be seen in many places in Britain. Trees of 15 and 20 feet in height are by no means scarce, and young ones are plentiful.

Some good specimens are growing at Calderstone, in Lancashire, Elvaston, Easton Park, and Highnam Court; and at Murthly Castle and Keillor in Perthshire, as well as at Riccarton, where in 1872 there was a fine specimen 30 feet in height. These are all more than 40 feet in height.

Commercial Statistics.—Price in 1851, plants 6 to 9 inches, 30s. each; in 1865, 12 to 18 inches, 5s. to 7s. 6d.; in 1875, 18 inches to 2 feet, 5s. to 7s. 6d.; in 1883, 12 to 18 inches, 2s. to 3s., 3 feet to 4 feet, 5s., 6 feet to 8 feet, 7s. 6d. to 10s.



PINUS PINASTER.

IDENTIFICATION.—PINUS SYLVESTRIS MARITIMA, conis firmiter ramis adhaerentibus, J. Bauhin, *Hist.*, i. p. 345 (1650); Tournefort, *Inst.*, p. 586 (1700); Gerard, *Fl. Gallo-Prov.*, p. 546 (1761).

PINUS MARITIMA ALTERA, C. Bauhin, *Pinax*, p. 492 (ed. 1, 1623; ed. 2, 1671); Duhamel, *Arbr.*, ii. p. 125 (1755).

PINUS SYLVESTRIS β ., Linnaeus, *Spec.*, p. 1418 (1753).

PINUS SYLVESTRIS, Miller, *Dict.*, n. 1. (1731).

PINUS PINASTER, Solander in *Hort. Kew.*, ed. 1, iii. p. 367 (1789); Lambert, *Genus Pinus*, ed. 2, i. p. 17 (1828); Lawson, *Agric. Manual*, p. 341 (1836); Loudon, *Arboretum*, iv. p. 2213 (1838); Loudon, *Encycl. of Trees*, p. 961 (1842); Antoine, *Conif.*, p. 18 (1840-46); Forbes, *Pinct. Woburn.*, p. 29 (1839); Link in *Linnaea*, xv. p. 498 (1841); Schouw, in *Annal. Sc. Nat.*, ser. 3, iii. p. 235; Endlicher, *Syn. Conif.*, p. 168 (1847); Lindley and Gordon, *Journ. Hort. Soc.*, v. p. 217 (1850); Knight, *Syn. Conif.*, p. 27 (1850); Lawson, *Abietineae* (1851); Carrière, *Traité Gén. des Conif.*, p. 365 (1855); Gordon, *Pinetum*, p. 176 (1858); Do., *Supplement*, p. 62 (1862); Ørsted, *Frilands-Trævæxten i Danm.*, p. 72 (1864); Henkel and Hochstetter, *Synop. d. Nadelholzer*, p. 25 (1865).

PINUS MARITIMA, Lamarek, *Encycl. Method.*, v. p. 337 (1804); De Candolle, *Fl. Franc.*, iii. p. 273 (1805); Duhamel, *Arbr.*, ii. (1755); Loisel, *Nouv. Duham.*, v. (1801-19); Spach, *Hist. Nat. Vég. Phaner.*, xi. p. 382 (1842); De Chambray, *Traité Prat. Arb. Rés. Conif.*, p. 251 (1845).

PINUS PINASTER MARITIMA, Loudon, *Arboretum*, iv. p. 2217 (1838).

PINUS LEMONIANA, Carrière, *Traité Gén. des Conif.*, p. 368 (1855).

Var. PINUS HAMILTONII, Tenore, *Cat. Neap.*, p. 90 (1845).

PINUS PINASTER HAMILTONII, Lindley and Gordon, *Journ. Hort. Soc.*, v. p. 217 (1850); Knight, *Syn. Conif.*, p. 27 (1850).

Var. B. MAJOR, Duhamel, *Arbr.*, ii. p. 133 (1755); Carrière, *Traité Gén. des Conif.*, p. 365 (1855); Gordon, *Pinetum*, p. 178 (1858); Henkel and Hochstetter, *Synop. d. Nadelholzer*, p. 27 (1865).

Var. PINUS PINASTER MINOR, Loisel, *Nouv. Duham.*, v. p. 242 (1801-19); Loudon, *Arboretum*, iv. p. 2216 (1838); Loudon, *Encycl. of Trees*, p. 963 (1842); Endlicher, *Syn. Conif.*, p. 169 (1847); Lindley and Gordon, *Journ. Hort. Soc.*, v. p. 218 (1850); Lawson, *Abietineae*, p. 39 (1851); Carrière, *Traité Gén. des Conif.*, p. 366 (1855); Gordon, *Pinetum*, p. 178 (1858); Do., *Supplement*, p. 62 (1862); Ørsted, *Frilands-Trævæxten i Danm.*, p. 73 (1864); Henkel and Hochstetter, *Synop. d. Nadelholzer*, p. 28 (1865).

Var. PINUS ESCARENA, Risso, *Hist. Nat. Eur. Mer.*, ii. 459 (1826-28).

PINUS PINASTER ESCARENA, Loudon, *Arboretum*, iv. 2214 (1838); Endlicher, *Syn. Conif.*, p. 169 (1847); Lindley and Gordon, *Journ. Hort. Soc.*, v. p. 217 (1850); Knight, *Syn. Conif.*, p. 27 (1850); Lawson, *Abietineae*, p. 39 (1851).

Var. PINUS LEMONIANA, Bentham in *Hort. Trans.*, ser. 2, i. p. 512 (1834); Lawson, *Agric. Manual*, p. 343 (1836); Spach, *Hist. Nat. Vég. Phaner.*, xi. p. 400 (1842).

PINUS PINASTER LEMONIANA, Loudon, *Arboretum*, iv. p. 2215 (1838); Loudon, *Encycl. of Trees*, p. 963 (1842); Endlicher, *Syn. Conif.*, p. 169 (1847); Lindley and Gordon, *Journ. Hort. Soc.*, v. p. 217 (1850); Knight, *Syn. Conif.*, p. 27 (1850); Lawson, *Abietineae*, p. 39 (1851); Gordon, *Pinetum*, p. 178 (1858); Henkel and Hochstetter, *Synop. d. Nadelholzer*, p. 27 (1865).

ENGRAVINGS.—*Leaves, Cones, &c.*—Duhamel (*op. cit.*), ii. t. 28, No. 2, and t. 29, No. 4; Loisel, *Nouv. Duham.*, v. t. 72, and t. 72, No. 1; Lambert, *Genus Pinus*, ed. 2, t. 9-10; Loudon, *Arboretum*, iv. figs. 2100, 2101; Loudon, *Encycl. of Trees*, figs. 1781, 1782; Antoine, *Conif.*, t. 6, fig. 1; Forbes, *Pinct. Woburn.*, p. 29; De Chambray, *Traité Prat. Arb. Rés. Conif.*, pl. ii. and pl. v., fig. 1.

Trees.—Loudon, *Arboretum*, viii. pls. 368, 369.

Specific Character.—Pinus foliis geminis magnis et elongatis stomatum seriebis pluribus instructis, vaginis brevibus, gemmis magnis squamas recurvatas ferentibus; strobilis verticillatis confertis ovatis sessilibus, squamis apophysi elevato pyramidato, umbone acuto; seminibus alatis.

Habitat in Galliæ littore Atlantico et Mediterraneo, in Lusitania, in Hispania præsertim in Estremadura, in Italia superiore, Apenninis borealibus et centralibus.

A large tree reaching about 60 feet in height, and usually pyramidal and with a conical top. The bark of the trunk is coarse and deeply furrowed. The branches are verticillate and erect. The leaves in twos [fig. 1], of a rather bright and pleasant green, reaching from 6 or 8 inches to even a foot in length, thick, long, firm, and rigid, usually without any waving or twisting, slightly serrated on the margins,



Fig. 1, natural size.

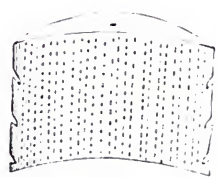


Fig. 2, magnified.

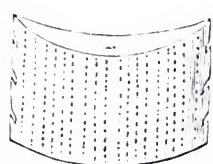


Fig. 3, magnified.

and with numerous rows of stomata both on the back and inner side, but varying according to size, rather more frequent on the back than on the inner side, the relative numbers being about a fifth more on the back, [figs. 2 and 3]. For example, a fine full-grown leaf shewed twenty-five rows on the back, and nineteen on the inner side; and a smaller less-developed leaf from another tree gave fifteen on the back to twelve on the inner side. The sheath of the leaf is short and blackish, from $\frac{1}{4}$ to $\frac{3}{4}$ of an inch in length. The buds are large, thick, and vigorous, cylindrical, with a conical apex as much as $\frac{3}{4}$ of an inch long, and $\frac{1}{2}$ an inch broad, with strong scales curled back, white and woolly, and free from resin. Figs. 4 and 5 shew them in the younger stage, fig. 6 when more advanced, and accompanied by young cones.



Fig. 4.



Fig. 5.

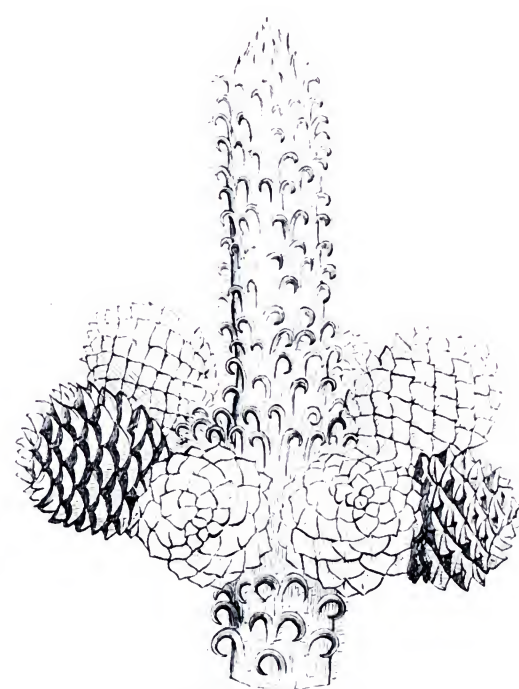


Fig. 6, natural size.



Fig. 7.

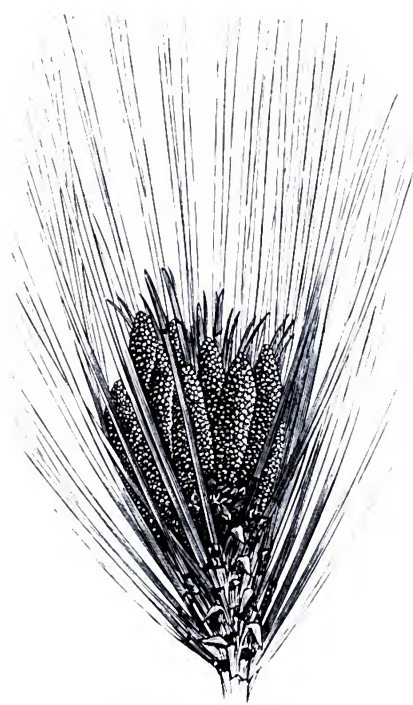


Fig. 8, slightly diminished.

These scales furnish a ready and easy character for distinguishing this species from almost every other. The branchlets are covered with the scars or corticeous remains of former scales, as shewn in fig. 7. The male catkins grow around the shoot of the current year [see fig. 8], and as the shoot extends they become further separated from each other. They are usually numerous, occupying, by the time they reach maturity, a space of 6 or more inches in length. When they drop off, of course they leave a bare space intermediate between the leafy termination of last year's shoot, and the leafy termination of the current year's shoot, which gives the foliage of the tree something of a patchy aspect, in which tufts of foliage and bare places alternate like some of the tufty American species of *Taeda*. This arises in a great measure from the length of the leaves, and the extent of space occupied by the numerous catkins. A single male catkin magnified is shewn in fig. 9. The anthers [figs. 10 and 11, magnified] are as usual bilocular, and the crest is rounded, and thin at the edge, but very slightly lacerated. The female catkins [figs. 12 and 6] grow around the central bud at the apex of the current year's shoot, which pushes on and leaves them behind it at its base.

Fig. 9.
Male catkin, magnified.Fig. 10.
Anther, magnified.Fig. 11.
Crest of anther, magnified.

PINUS PINASTER.

3

Fig. 13 shews a single female young catkin magnified; figs. 14 and 15 the scale and bract of the flower in different positions, magnified. Next year's shoot leaves them behind in a cluster or star-like clump at its base, the young lateral shoots sprouting out above them. The star-like cluster of cones is the feature which has given the name *Pin-aster* to this section of the Pines. The young cones are at first purple. They very soon, however, become green; and the second year, by the time the cone becomes mature, the green turns into a rich fawn-colour. They are arranged in a succession of whorls, varying in number, which together form a large cluster of cones. The numbers in the clusters are very variable. M. Loiseleur des

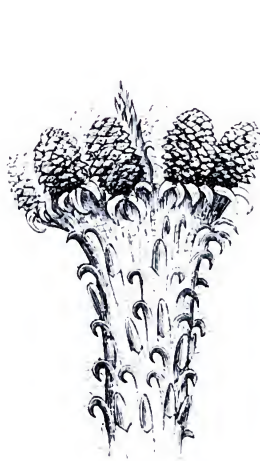
Fig. 12.
Natural size.Fig. 13.
Female flower, magnified.

Fig. 14.



Fig. 15.

Scale and bract of female flower, magnified.



Fig. 16.



Fig. 17.



Fig. 18.

Scales of cone, natural size.

Landes of Bourdeaux, where the trees send down their tap-roots to a great depth, clusters are sometimes found containing as many as 30 or 40, or even 80 or 100 cones. The full-grown cone is from 4 to 6 inches in length, and from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches in breadth at the broadest part. It is conical, but more developed on the exposed side than the other [see plate]. The scales [figs. 16 and 17, representing the inner and outer side, and 18 a side view] are from 1 to $1\frac{1}{4}$ inches in length, and from $\frac{1}{2}$ to $\frac{3}{4}$ in breadth at the widest

part. The apophysis is rhomboidal and pyramidal, transversely divided by a raised keel, with a hard rhomboidal umbo in the centre, of an ash-grey colour, terminating in a small sharp point. The inner side is all dark-brown except a narrow edging of pale-fawn colour parallel to the margin. The remains of an obliterated defaced bract lie at the base of the back of the scale [fig. 19]. The seeds have a broad but not very long wing [fig. 20]; it is from 1 to $1\frac{1}{2}$ or $1\frac{3}{4}$ inches in length, and about half an inch in breadth. The seed itself is about three-eighths of an inch in length, and not quite one-fourth in breadth; it is brown and without spots. The cotyledons are seven or eight in number.

Fig. 19.
Bract.Fig. 20.
Wing of seed.

The tree flowers in April in the Landes, but later in England (May and June), and the fruit does not attain maturity until the autumn of the following year.

This Pine has a deep tap-root—Loudon says deeper ("Arboretum," iv. p. 2218) than any other European species, and where the soil is dry and sandy it descends perpendicularly into it like the root of a broad-leaved tree. The horizontal roots, on the other hand, are few compared with those of the other Pines; so much so, that from its having few fibrous roots, it is often a matter of some difficulty to get the young plants to transplant with safety. The tree grows very rapidly; shoots of 5 feet in one year being sometimes met with. In twenty years' time, a tree, under favourable circumstances, will reach 30 feet in height. The timber, as might be expected, is soft, and of little value for the ordinary purposes to which timber is put. A tree cannot be said to be worth much whose chief uses are derived from its combustion, as is the case with the *Pinaster*.

VAR. *Escarena*.—The characters of the variety *Escarena* are, according to Loudon and subsequent authorities, that the leaves are of a paler green than those of the type, and the cones shorter and more ovate. Loudon says it is the most distinct and handsome variety of *Pinaster* that he had seen. It was introduced into this country by the Earl of Aberdeen from the mountains near Nice, where it had been found by M. Risso, growing, though rather sparingly, about twelve or fifteen miles from the city. It may be very distinct in its native habitat; but judging from a specimen in the Horticultural Society's

Garden

Garden at Chiswick (which was presented to the Society by Lord Aberdeen from the plants raised from the seeds he brought to England), we can see little if any difference in this country.

VAR. *Lemoniana*.—The variety *Lemoniana* was named by Dr Lindley after Sir Charles Lemon, who found it growing in his plantations (we presume at his place, Carclew, in Cornwall), and who was struck by its apparent difference from the *Pinaster* in some respects, notwithstanding its close resemblance to them in others. In November 1833 he communicated an account of it to the Horticultural Society, in whose *Transactions* it was published (2d ser., vol. i. p. 509, 1835). From that paper it appears that he had shewn specimens of the Fir to Dr Lindley, Mr Lambert, and Mr Don, and that these gentlemen were of opinion that it was a variety of *Pinaster*, perhaps accidental, but at most a permanent variety, induced by circumstances of climate and soil. In that opinion he at first seems to have acquiesced, but afterwards came to doubt it, in consequence of his having subsequently observed some hundreds of specimens, and found in each an unbroken constancy of character, which appeared to him inconsistent with the hypothesis of accident or modification; and, looking upon it as a botanical problem of some interest, which it undoubtedly is, he brought it under the notice of botanists and arboriculturists in general in the paper in question. He suggested, but does not seem to have had much faith in the idea, that by means of the constant communication between Falmouth and distant parts of the world, seeds might have been brought from abroad and raised indiscriminately with the *Pinaster* by some nurserymen, who may have supplied the planters of the neighbourhood; but, as he says, it is still difficult to imagine that any species so accessible should have escaped the observation of botanists and yet remained undescribed.

The leading characters of the specimens which puzzled Sir Charles consisted in the form and position of the cone, and the effects on the growth of the tree resulting from that position. Compared

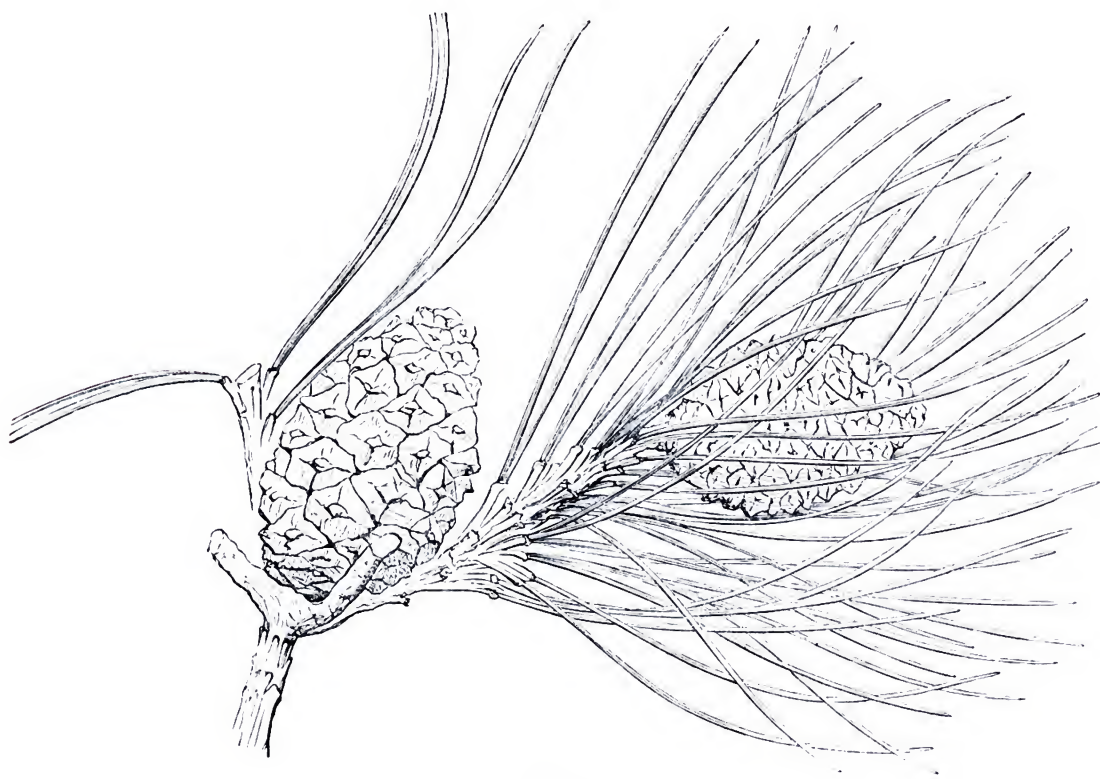


Fig. 21.

VAR. *Lemoniana*—copied from original plate.

Lemoniana, on the contrary, the cone is single, and it as universally occupies the place of the leading shoot, the lateral shoots being behind it, but not immediately or closely behind it. The necessary consequence of this is what Sir Charles points out, namely, that the tree *can* have no regular leader, but each year one of the side shoots strengthens and continues the growth for the ensuing season. The following year the same process is repeated in another direction, a new axis of growth is formed, and the stem of the tree acquires a zigzag appearance, which is never entirely lost, though of course more or less obliterated by age.

The general appearance of *Lemoniana* is that of a short bushy *Pinaster*, with a zig-zag stem, and the branches

with the common *Pinaster*, to which Sir Charles and every one else admit it to be allied, the cone is smaller, more ovate, tapering but little towards the base, and having moderate-sized unarmed scales, with shallow furrows between them. The woodcut [fig. 21] is a copy of Sir Charles's representation of the cone and its position, which latter he considers a still more striking distinction. In the common *Pinaster* the cones, of which there are almost always several, are situated behind the shoots of the whorl, and in a mature state point backwards. In the variety

branches close and twiggy. Retarded as it necessarily is by the conditions of its growth, it does not increase in height *pari passu* with its neighbours; but there is nothing dwarfish or diseased in its appearance, nor does it exhibit any peculiarities of constitution to which other Firs are not subject. "Occasionally," says Sir Charles, "as do the *Pinaster* and Scotch Firs, it kills itself by an exuberant bearing of cones" (or, if we may alter the phrase, it produces an exuberant crop of cones when about to die), "and it then assumes a very extraordinary aspect, reminding me of the groups of little wooden buds perched on the ends of sticks, at which the people of Holland and Belgium shoot for prizes with bows and arrows. The foliage is gone, and the tree is reduced to a collection of dry sticks, each terminated by a cone." The illustration drawn from the pastimes of Holland and Belgium may not now be so applicable or familiar as it was thirty years ago, but the description does not need it.

The largest tree which he had seen was a specimen which he believed to be thirty-five years of age, and it was 44 inches in girth, at 4 feet from the ground; but many of smaller growth assumed all the characters of the variety at eight or nine years of age; and even young plants only three years old, grown from the seeds of older specimens, already shewed symptoms of the same peculiarities.

It may be as well first to notice the conclusions arrived at by Sir Charles Lemon as to the nature of these peculiarities, and then to see how far they, as well as the foregoing facts, agree with subsequent observation of the variety and its growth. He considers that the distinctive characters may indicate either a distinct species, a hybrid, or an accidental, and perhaps permanent, variety.

Against its being the first he has the opinion of the before-mentioned eminent botanists, and the fact that no such species has been observed in any other part of the world. Against the second (its being a hybrid of the *Pinaster* with some other Fir) there is the objection that amongst many specimens gradations must necessarily occur, and in various instances the hybrid would approach more or less near to one or other of its parents. But in the trees which he found growing in his plantation there is no such mixture. They were altogether *Pinaster*, or altogether of this variety: and amongst many scores of specimens which he had examined he never found one which partook of both forms of growth; in no one instance did he ever see a cone in the place of a leading shoot in one part of a tree, and in its ordinary situation in another. We agree with Sir Charles Lemon in regarding this to be conclusive against the notion of the tree being a hybrid, but we cannot follow him when he holds that the argument is almost as applicable to the only remaining solution, namely, that the tree may be a variety induced by peculiarities of climate and soil, and exhibiting the ordinary effects of such change.

"Here also," he says, "it is difficult to conceive that in some part of some trees where the conversion might be incomplete, indications of an effort to adhere to the original type should never appear; but these indications are, as far as my observation goes, totally wanting, and the conversion, if such it be, is either complete or not commenced. There are also other difficulties in the way of this last supposition. Changes of organs, I apprehend, take place only by multiplication of parts, by abortion, or by conversion of the rudiments of the infant shoot according to a fixed rule of progressive development—whether from the centre to the circumference, or *vice versa*, I will not now inquire, for in neither direction can we find any explanation of a counterchange of parts by which the cones and shoots should be reciprocally converted. Where multiplication takes place, the side-shoots become very numerous, and this is so common as almost to form a character of the tree. Where abortion takes place, the side-shoots are diminished in number, and sometimes totally wanting, and the cone is left singly terminating the branch. In the former case, the cone itself is sometimes absent; still no regular leader supplies its place, but a broad disc marks the situation on which the cone should have stood" [that is, rather the situation from which the cone has dropped].

The whole particulars above given are characteristic of weakness. The occasionally *numerous* side-shoots are not less so than the occasional *absence* of side-shoots. Two or three powerful shoots are evidence of strength; a multitude of small ones (and where they are numerous they must be small and weak, for there is no room for strong ones) is evidence of weakness. They evince the desire to make wood, but not the power. Regarding the plant as suffering from weakness, we shall have no difficulty in explaining all the facts without having recourse to Sir Charles's idea that the terminal cone is a converted shoot. The simple history of the cone is this: fig. 12 (*supra*) shews the natural and normal starting-points of the leading shoot and cones. Both the typical *Pinaster* and the variety *Lemoniana* start in this way, but in the latter there is not a sufficiency of sap to nourish both the bud and the cones too. There is only

enough,

enough, it would appear, to supply one of them. Which would nature select under such circumstances? We know that whenever a plant is feeble, moribund, or in danger, the first thing nature looks to is the propagation of the species. Often the first indication of a plant's being in an unhealthy state is an excessive exuberance of flower and fruit, when, to use the expression made use of by Sir Charles Lemon in one of the passages above quoted, the plant kills itself by excessive bearing. The same thing happens in the growth of the shoot and the cone above figured. In the weakly state of the subject, nature gives the preference to the development of the cone over the shoot. The branch cannot support both, and the favoured cone gradually usurps the place of all the others, both shoot and cones, shoving them aside, so that they by-and-by drop off. It is not a matter of conjecture. Fig. 22 is a sketch of a young shoot of *P. Lemoniana* in which the favoured cone has become abortive from some cause (apparently the attack of an insect), after having grown a certain length, and we have here the leading shoot of the branch still present, only shunted a little out of the way by the pressure of the



Fig. 22.

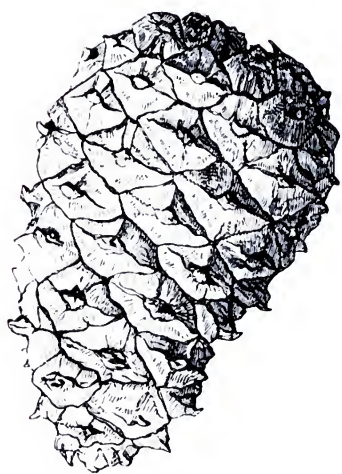


Fig. 23.

nascent cone. Nothing can more clearly prove that there is no conversion of leading shoot into cone. This illustrative specimen is taken from an example of *P. Lemoniana* growing in the Royal Horticultural Society's Garden at Chiswick, and originally supplied by Sir Charles Lemon himself. The tree there still preserves its constitutional idiosyncrasy. The cones are still produced singly at the termination of the branchlets; but the situation must, to a certain extent, be more favourable to its growth than that at Carclew, for the cone, although single, has increased in size, and lost the special characters which Sir Charles gives as characterising the cone: For example, although still smaller than the cone or the *Pinaster*, it is not very much so, and is nearly twice the size of the cones figured by Sir Charles. Fig. 23 represents it; it is not so ovate as

they are, has more of the form of the *Pinaster* cone, and the scales are not unarmed, many having the umbo terminating in an acute point.

In the *Pinaster*, as in all Pines, individuals occur which produce smaller cones and shorter leaves than others. These occur mixed up with the others. In the Landes of Bourdeaux they are only occasional, but as we go farther north and into a colder climate they become more frequent. They abound, according to Bosc, in the barren sands on the west coast of France, in the neighbourhood of Mans; and Loudon remarks that, judging from the specimens with cones which he had received from different parts of the country, these small-coned individuals seem to be common in England. M. Loiseleur des Longchamps supposed these less flourishing individuals to be a variety of the species, and described it under the name of *P. Pinaster minor*, while the normal more flourishing individuals came to be named *P. Pinaster major*. Bosc, mistaking the nature of the phenomenon, supposed them to be hardier and more suitable to a cold climate than the var. *major*; while, on the contrary, the truth is that the so-called variety consists merely of stunted individuals of that very kind occasioned by a climate not sufficiently warm for its perfect development.

The tree has been a favourite for some time, and has been apparently more extensively and for a longer period introduced and cultivated in other countries than most other Conifers. It is so cultivated in China, Nepaul, New Holland, St Helena, &c.; and botanists finding it in these countries, have sent home specimens and seeds, which have in consequence been named *Pinus Chinensis*, *P. Nepalensis*, *P. Novæ Hollandica*, and *P. St Helenica*. They are, however, merely the produce of the normal species, introduced and cultivated in the country named.

Geographical Distribution.—The *Pinaster* is a native of what is called the Mediterranean district of Europe. It occurs in Spain and Portugal, and is abundant in the south of the former, as Estremadura, and the west of the latter. It also occurs on the opposite coast of Algeria. A tree which is met with in commerce under the name of the Pine of Edough, is, according to M. Carrière, probably nothing but the

the *Pinaster*, which, he says, grows in great quantities in the forest of Edough, near Bone, in Algeria. It also occurs on the Mediterranean coast of the south of France. In Italy, according to Schow (Schow "On the Coniferous Plants of Italy," translated in *Journal of the Horticultural Society*, vol. iii. p. 119), it grows on the sandy plains and on the lower mountains on the south slope of the northern and on the western slope of the central Apennines—Pægli, Sestri, Spezia, Sarzana, Viareggio, Marchia di Pisa, Mont Pisano, as well as, according to Savi, in the Maremmes of Sienna, and on the different groups of mountains to the west of the Apennines, and even on Mount Argentaro, according to Brocchi. It is not found to the south of this mountain, nor before we come to the north of the Apennines. It has been said to have grown on the Pianura del Cavallino, near Venice (Pollini, Naccari); but Professor Schow states that the specimens he found in that locality belonged to *Pinus Pinea*; for although they had no cones, the young leaves were ciliated, and the old ones thinner and stiffer than those of *P. Pinaster*. The Professor also mentions that the variety with shorter leaves and smaller cones seems to prefer the low mountains, whilst the larger-leaved, larger-coned variety prefers, on the contrary, sandy plains: a sufficient indication of which is the natural habitat of the tree. The upper limit of this tree in the Apennines is 2800 feet above the sea (Mont Pisano). This species has been said to occur in Austria and Hungary, but Professor Schow says that what has there been taken for it is nothing but *P. Austriaca*. Visiani, however, says it grows in the islands of Brazza, Lesina, and Carzola.

It is also a native of Corsica, where it takes the form of the variety named *P. Hamiltonii*, which more particularly abounds in the neighbourhood of Corte, a small town in Corsica, where it attains large dimensions. That variety is frequently designated as the "Pin de Corte," from the name of this town. It is the same variety which occurs in Spain and Italy.

The *Pinaster* is also a native of Greece, and extends into Asia Minor. M. Kotschy states that he found the *P. maritima* on the Cilician and Caramanian mountains; but the *P. maritima* referred to by him is not *Pinus Pinaster*. From specimens collected by him and preserved in the Kew Herbarium, we see that his *P. maritima* is *P. Brutia*, a different species. But Prince Tchihatcheff ("Asie Mineure," ii. p. 306) states that it is found in Bithynia and Cilicia, and that it is widely spread in the latter on the southern slope of the Boulgardagh, especially in the neighbourhood of Galek, and that it extends up that mountain-range as high as 1786 metres; and there seems to be no doubt that he refers to the true *P. Pinaster* and not to *P. Brutia*, like Kotschy; for he not only specifies it as "*P. Pinaster*, Soland., *P. sylvestris*, var. *P. maritima* Lurk. non. Ait.," but adds *P. Brutia* as an Asia Minor plant, giving Pontus and the Boulgardagh (Cilicia) as the localities, and citing Kotschy's collection. There is no evidence of its ever having been found farther east than Asia Minor.

Lambert gives Switzerland as a habitat of this tree: "On the mountains of Switzerland the native forests are seldom suffered to stand, being usually either cut into shingle for covering the roofs of houses, or employed for the extraction of pitch." And Loudon, perhaps merely adopting his statement, says, "It abounds in Switzerland, where its timber is said to be used in forming shingles." The allusions here must be to the Italian Alps, for in the true Swiss Alps we believe it does not occur. It is not in Host's "Flora Austriaca," nor in Hausman's "Tyrol Flora," two of the most recent and reliable authorities.

History.—Before this species was described by any scientific botanist (which appears to have been first done by Bauhin in 1623), it had been already introduced into England by Gerard in 1596. We still have some old trees remaining, but none nearly approaching that date. Until a few years ago the individual tree which had the reputation of being the oldest was one which grew in the garden of the Bishop of London's Palace at Fulham, but it dated only from about 100 years afterwards, viz., 1685; it died about 1862, and was then cut down. It was 80 feet high when measured for Loudon in 1835. The next oldest are said to be at Syon, Pains Hill, and Whitton. The largest mentioned by Loudon were some at Westwich House, Norfolk, which in about 100 years (planted in 1702, and measured

in

in 1809) were upwards of 80 feet high, and contained about eight loads of timber each. There is one at Croom Court, in Worcestershire, 90 feet high, and many all over the country from 40 to 60 feet.

Major-General Beatson, Governor of St Helena in 1811, mentions, in letters published in the *St Helena Register*, dated 22d July and 18th September, that most of the *Pinasters* at Plantation House, St Helena, were raised from seed brought by Mr Henry Porteous, and sown on the 1st of July 1787. He gives the girth of some of the largest of the trees in 1811: one was 5 feet 7 inches in girth, others from 5 to 3 feet, or even less (all at 4 feet above the ground), the difference in size being due to the kind of soil in which they were planted. The product of one single tree was in all 193 superficial feet. The first 7 feet above ground squared to 13 inches. The whole of the stem measured 146 superficial feet, and the large branches contained 47. The size of another specimen was 4 feet 8 in girth at 1 foot from the ground; 3 feet 7 at 2 feet from the ground; and 58 feet in height, of which 40 feet was serviceable timber.

It is of little value as a timber tree, but has proved extremely useful for shelter and decoration. It is one of the few Conifers which thrive in sand, and under exposure to the sea-breeze; and has been found invaluable, on account of these properties, in reclaiming some, and preserving from desolation other, large tracts of sandy dunes, more especially on the western coasts of France. The Landes in the Gulf of Gascony are composed of loose drifting sand, which in 1789 covered 300 square miles. M. Bremontier, of the then Administration of Forests in France, set himself to fix this mercurial surface, and the means he used were planting it with the *Pinaster*. In a report of his proceedings, he compared this surface to a billowy sea.

"It offered nothing to the eye but a monotonous repetition of white wavy mountains perfectly destitute of vegetation. In times of violent storms of wind the surface of these downs was entirely changed; what were hills of sand often becoming valleys, and the contrary. The sand on these occasions was often carried up into the interior of the country, covering cultivated fields, villages, and even entire forests. This takes place so gradually (by the sand sweeping along the surface and thus raising it, or falling from the air in a shower of particles so fine as to be scarcely perceptible) that nothing was destroyed. The sand gradually rose among the crops as if they were inundated with water, and the herbage and the tops of trees appear quite green and healthy, even to the moment of their being overwhelmed with the sand, which is so very fine as to resemble that used in England in hour-glasses. On this moving and shifting sea, M. Bremontier sowed seeds of the common Broom mixed with those of the *P. Pinaster*, commencing on the side next the sea, or on that from which the wind generally prevails, and sowing in narrow zones, in a direction at right angles to that of the wind—the first-sown zone being protected by a line of hurdles, this zone protecting the second, the second the third, and so on."

To prevent the seed being blown away before it had germinated and become firmly rooted, he protected it by various ingenious modes, such as hurdles and thatching, and he had at last the gratification, after conquering many difficulties, of seeing his first zones firmly established. The rest was then comparatively easy, and by rapid degrees the *Pinaster* covered the whole of these sandy downs; thus not only providing the interior country with a barrier against the assaults of the sands, but turning the downs themselves from a desolate waste into a source of productive industry.

The details of the whole process are thus quoted at length by Loudon:

"From 4 lb. to 5 lb. of Broom seed, and from 1 lb. to 2 lb. of *Pinaster* seed, are sown per acre, and immediately covered with branches of Pines or of other trees with the leaves on, brought from the nearest woods, in order to shelter and protect the seed, and by help of the hurdle fence to retain the sand. These branches are laid down in a regular manner in the direction of the wind, and overlapping one another, so as to produce a sort of thatching to the surface; and in places very much exposed rods are laid across them and firmly hooked down. In a word, wherever seeds are sown, the surface of the downs, as far as the sowing extends, may be said to be carefully thatched; branches of evergreen trees being used instead of straw. In six weeks or two months the Broom seeds have produced plants 6 inches in height, and which attain three or four times that height in the course of the first season. The Pines do not rise above 3 inches or 4 inches in the first year; and it is seven or eight years before they completely overtop the Broom, which often attains in these downs from 12 feet to 15 feet in height. At the age of ten or twelve years, the Pines have in a great measure suffocated the Broom, and they are then thinned; the branches cut off being used for the purpose of thatching downs not yet recovered, and the trunks and roots cut into pieces and burned to make tar and charcoal. In about twenty years the trees are from 20 feet to 30 feet in height, and they are now prepared for producing resin, which process is carried on for ten or twelve years, when the trees are cut down and their branches applied, as before, for thatching, and their trunks and roots for making tar and charcoal, the self-sown seeds having furnished the surface with a progeny to succeed them. In 1811, a commission, appointed

PINUS PINASTER.

9

appointed by the French Government, made a report on the downs, and announced that about 12,500 acres of downs (from Bayonne to Medoc in the one direction, and from the sea to the mouth of the river Garonne in the other) had been covered with thriving plantations, and that it was found a thatching or covering of any kind of vegetable herbage, such as straw, reeds, rushes, seaweed, &c., might be used instead of branches, and was even preferable. Another improvement which had been tried and found very successful was the substitution of a fence of boards for that of wattled hurdles, so as more completely to exclude the wind."—(*See* "Dict. des Eaux et Forêts," tome i. p. 816.)

Although the timber is of little value, the manufacture of tar, turpentine, and other resinous products furnishes sufficient occupation for the inhabitants, who are thinly scattered over large spaces. Among the efforts of man to control the elements and alter the face of nature, the conquest of the Landes from the desolation of the desert is entitled to a place beside the recovery of Holland from the empire of the sea.

Mr Brown ("Forester," p. 247) recommends a different mode of planting the *Pinaster* along sea-coasts from that followed so successfully in the Landes by M. de Bremon tier. It is evident, however, that the nature of the soil on which he recommends his procedure is something very different from the shifty and uncertain sand-waves treated by M. Bremon tier. Mr Brown's plan is this :

"Line off a broad belt of land all along the length of the coast to be planted, not less than 200 yards in breadth ; and as a fence to this, upon the side next the sea, erect a stone dyke if possible, in order the more readily to bring away the trees, by having a little shelter from the sea. But if stones for this purpose are not to be got conveniently, erect a turf dyke of about 4 feet in height. The fence inside may be a hedge or otherwise, as taste or local circumstances may suggest. Care must be taken, upon all jittings of land bending out into the sea, to make in the line of fence a bold convex bend in the same direction, this being in addition to the general width. Having the fence erected, plant the ground all over with Norway Maples and Sycamores, of each an equal number, at about 12 feet apart ; that is to say, if the land be of anything like a loamy nature, and adapted to the growth of those trees. Having the hardwood planted, make up all the spaces between them with good strong plants of the *Pinaster*, till the ground all over have young trees averaging 4 feet apart. The hardwood plants will not come away rapidly, and will in all probability die down to the ground the second year after being planted. But the proprietor must not be at all discouraged upon this account, for it is quite natural that the young plants should do so, as they must suffer a very severe check by being at once transplanted from a nursery to the open ground upon the sea-coast. In order to strengthen the young Maples and Sycamores as much as possible, when they have remained one year upon the forest ground, have them all cut over by the surface of the ground, and the year following they will set away young shoots, which will bear the climate they rise in, the more so as by this time the *Pinasters* will be beginning to grow rapidly, and cause a little shelter over the ground. If the ground intended for the *Pinasters* be of a sandy nature, it would not be advisable to plant either Maples or Sycamores upon it ; therefore, in such a case it will be much better to plant the ground all over with *Pinasters* alone ; for, although the Maple and Sycamore both stand the sea-breezes well, still if the soil upon which they are planted be not of a loamy nature, they have not much chance to rise to any good, but would remain small unsightly things."

What good purpose is to be served by planting Maples and Sycamores along with the *Pinasters* we do not see. It cannot be to serve as nurses to the *Pinaster*, seeing that they want all the properties that a nurse should have, such as thick evergreen foliage with rapid growth ; nor can it be intended that they are to be the permanent crop, and the *Pinaster* to serve as nurse to them, for throughout they are directed to be treated as secondary to the *Pinaster*, and sacrificed to it throughout. We prefer either Bremon tier's Broom or a homogeneous plantation of *Pinasters*, without any admixture at all.

The *Pinaster* has been used in this country under similar circumstances, and with like results to those in the Landes. Mr Bromfield mentions (*Phytologist*, 1850, p. 888) that a Pine (which he refers with doubt to this species) has been introduced in England near Bournemouth, between Poole and Christchurch, in some marshy land, which is spreading by its own seeds, and has already imprinted on the country a character analogous to that of the Pine barrens of the United States. Large plantations of *Pinaster* have been made on the sandy soil of Norfolk, and as an ornamental tree it is very generally distributed, some of its many varieties being less dependent on proximity to the sea than others ; but, as a rule, it thrives best when planted near the sea and in sandy soil. But, although so well adapted for sandy sea-dunes, it is by no means equally suited for what would generally be considered better situations. Mr Brown ("Forester," p. 247) tells us that during his experience as a forester he has frequently had occasion to remark that, hardy as the *Pinaster* is in withstanding the influence of the sea-breezes, it is but a tender plant when planted in a high elevated part of the country inland ; and he gives the following illustration of the fact :

[26]

E

" Upon

"Upon the estate of Dunskey, which runs partly along the sea-shore from Port Patrick towards Stranraer, the *Pinaster* has been plentifully introduced along the higher grounds bordering upon the sea-shore, in order to form a protection to the plantations of hardwood growing inside. It has answered the desired end there, having grown rapidly and healthily, securing in a very few years an amount of shelter which could not have been obtained by any other sort of tree. . . . Upon more elevated parts of the same estate the *Pinaster* was also planted, at from about 400 to 500 feet above the level of the sea; but in such parts the plants did not succeed well, and consequently their cultivation upon these elevated inland parts has been given up."

As to the growth of the *Pinaster* in Scotland, Mr Brown says:

"It must not be expected that the *Pinasters* will rise high, or make fine-looking trees for a number of years. On the contrary, they will spread rather low, and form a very bushy habit for at least the first twelve years. This habit of theirs is their security; for a tree that would incline to rise high in such a situation would be at once thrown into bad health, while the *Pinasters* spreading themselves, soon form a complete massive shelter to everything else near them; and by the time they arrive at about fifteen years old, they begin to rise upwards rapidly, being by this time perfectly established in their situation."

Even at its best, however, it does not appear ever to get beyond 50 feet in height in Scotland. That is about the height of a number of these trees in the parish of Moffat, in Dumfriesshire, whose introduction there is thus pleasantly described by the late Dr Fleming:

"Dr Walker, who long occupied with distinction the Chair of Natural History in the University of Edinburgh, was, when minister of the parish of Moffat, regarded as rather of weak intellect, in consequence of the fondness which he displayed for weeds and vermin. On returning one afternoon in spring from Edinburgh, he was observed to have the pocket of his coat full of what appeared to be *Fir branches*. The witnesses now imagined that a crisis in his lunacy had arrived, and began to set a watch on his future motions. He was observed in the course of the evening going forth to a corner of the glebe and putting some plants into the ground. When he had retired to the manse, the spies immediately proceeded to the spot, and found that he had been planting some young *Firs* (that these had appeared as branches sticking out of his pocket), and hence they were led to conclude that their minister was not so great a fool as they had suspected. The plants took root, were protected, and, as trees, now prove an ornament to the glebe, and a monument of the Doctor's arboricultural tendencies. These trees must now (1857) be at least seventy-three years of age, and one is 45 feet in height, and 6 feet 3 inches in circumference at the ground; and they to this day preserve the name of *Pouch Firs*, in memory of the part of the Doctor's dress in which they were first observed."

Properties and Uses.—Of course, wherever timber is, however worthless it be, some use will be made of it. In the marine arsenal at Toulon, the timber of the *Pinaster* is employed for the outer cases of the packages used on board vessels, and also for the piles and props which are used for sustaining the frames of vessels while building. In other words, the timber is applied to the most inferior purposes to which it can be put. But its real commercial uses are even lower than this: they are the production of resin, by withdrawing the juice of the tree by a system of tapping; and of lampblack, by burning the wood. Loudon gives a full account of both processes; but as these may rather be considered of the nature of chemical or mechanical manufactures than arboricultural details, we shall refer the reader who may wish for information regarding them to his work, the "Arboretum Britannicum," vol. iv. p. 2221. The manufacture of these products, however, is a most important matter for the inhabitants of the province of Guienne, for, thanks to M. Bremontier, the peasantry between Bourdeaux and Bayonne are mainly supported by the preparation of tar and resin from the pignadas or *Pinaster* forests. It is to be remembered, however, that although the inhabitants of these districts derive a scanty living from the extraction of these products, we should not be equally successful were we to attempt to deal in the same way with the *Pinasters* growing in this country. The resinous sap does not flow in the trees here in anything like the same quantity or richness as in warmer climates. An attempt to extract resin from trees in this country, as is done in the Landes, would prove commercially a failure.

Notwithstanding the little value of the *Pinaster* for economical purposes, it is always welcome for decoration. Its rich green, its rapid growth, its dense mass of foliage, and its magnificent leaves and shoots, render it very effective.

According to Major-General Beatson, the *Pinaster* has undergone a remarkable change in the quality of its timber by transplantation to St Helena. Writing to Sir John Sinclair (St Helena, 18th Sept. 1811), he says, "I beg leave to present you with a specimen of *Fir* timber, the produce of

PINUS PINASTER.

11

of *Pinaster* trees raised in this island. The transmutation which has been effected by some natural cause or causes in the texture and appearance of Fir timber seemed to me so curious and extraordinary, that I could not deny myself the gratification of submitting it to the inspection of yourself," &c. He also communicated with Sir Joseph Banks on the subject, and, in writing him, said that although many trees of different sorts had been tried at St Helena, there were none so peculiarly adapted to the climate and soil, nor that stood the almost unceasing south-easterly wind so well, as the *Pinaster*. "In the higher and cooler parts they thrive surprisingly; but in those less elevated, and towards the north and south extremities of the island, the summer heats are too powerful for the propagation of trees that are indigenous to the colder climates. When sheltered under the leeward sides of the hills, against the prevailing south-east wind, it grows straight and beautiful, and arrives at the height of 50 to 60 feet in the space of twenty-four years."—(Beatson's "Tracts relating to St Helena," p. 49.) The timber thus altered by growth at St Helena is described by the General (*loc. cit.*) as of a very superior quality, differing materially from either the Memel or the American Fir, being of a closer grain, beautifully veined, and resembling in some degree a pale Mahogany.

The *Pinaster* (at least in the Landes) seems peculiarly liable to the attacks of insects. M. Perris of Mont-de-Marsan in the Landes, an eminent French entomologist, has for some years past found occupation in tracing the habits and transformations of the different kinds of insects which prey upon it, and has already recorded those of upwards of 120 species as parasites upon this tree. It is satisfactory to learn from him, not so much on account of this particular tree, but as a fact which by inference must be applicable to all trees, that "he cannot admit that these insects are the primary cause of the death of the trees which they attack; and that during the fifteen years for which he without intermission studied their habits in one of the best-wooded countries in France, he had observed a sufficiency of facts to justify him in expressing his opinion, that insects in general (not including those which attach themselves solely to the foliage as miners, &c.) do not attack those trees which are in good health, but they only address themselves to those whose health and functions have suffered from some cause or other;" and he expresses his perfect conviction "that lignivorous insects are only to be dreaded by sickly trees. They are like some mosses and lichens which only attach themselves to enfeebled trees, while healthy well-growing trees preserve a smooth bark, and repulse these vegetable parasites."—(Perris, in *Annal. Soc. Ent. France*, 2me série, vol. x. p. 513.)

Culture.—The first and most essential requisite to the successful cultivation of the *Pinaster* is a sandy soil, and the second a sea-breeze. It will never grow so well under any other conditions, and there are some in which it is absolutely hopeless to attempt to grow it. Such are a chalky or any kind of calcareous soil, peat, or any stiff wet loam; to which, perhaps, may be added, in Britain, any considerable elevation above the sea.

The usual time for sowing the seed is towards the end of April; but if the season be late, and if there be any appearance of frost, the sowing may be delayed until the first week of May. As the *Pinaster* makes few fibrous roots, their growth must be encouraged by transplanting twice at least before being planted out. At one year old they may be transplanted from the seed-bed into lines, about six inches apart, two inches being left between the plants. The ground chosen should be light and sandy, without manure. When two years old they should be again transplanted, leaving about four inches between the plants and twelve inches between the rows. At three years old they may be lifted and planted where they are to remain.

Mr Brown, in his "Forester," recommends that, in planting, a few men should be employed taking off turfs, about 2 inches thick and 12 inches square, from the exact spots where it is intended the plants are to be put in; which turfs, as they are taken off, should be divided into two equal halves. After the plants are put in the turf should be put on the opening from which it was taken, but with the earth or under side uppermost, making it meet close upon the plant upon each side; and when it is thus placed, the seam or

opening

opening in the middle of the turf must be neatly and closely fitted together, by using a little of the earth from each of the edges of the turf. It should receive a good tramping with the feet over all, so as to keep out the drought in the early part of the summer, until the plants take root.

The *Pinaster*, when planted in suitable situations, is perfectly hardy in Britain. From Mr Palmer's Tables, it appears that the worst effects of the winter of 1860-61 were merely two killed and one much injured out of twenty-five places from which reports were received: all these in England, the much-injured one in Cornwall. The two killed were at Pamperford Hall in Cambridgeshire, and at Sudbrooke Holme in Lincolnshire; and the deaths in both counties were exceptional, being referred in the one case to the roots having been pot-bound, and in the other from the plant growing in a low wet place; another growing on a bank in a sheltered situation, but close to the water, was not injured.

In the north of France, Belgium, and the north of Germany, it does not thrive, although it is cultivated for decoration.

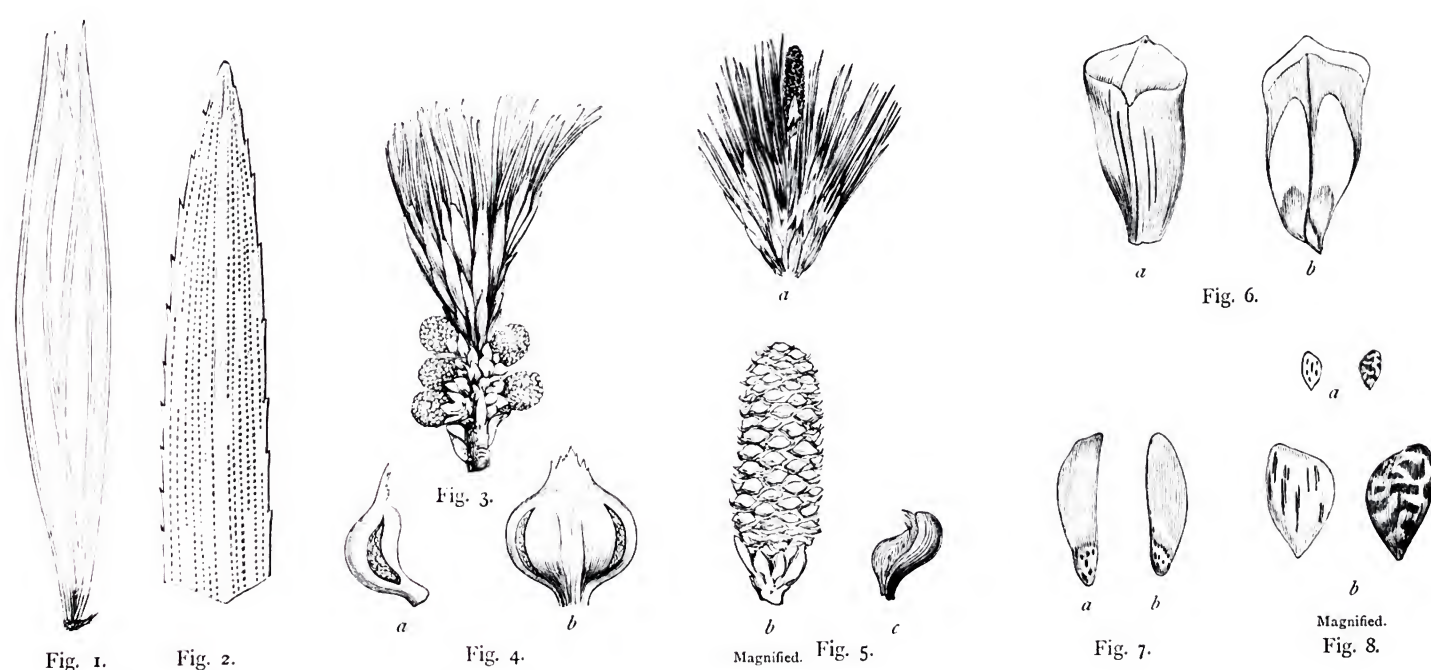
Commercial Statistics.—In 1850 the price of 1-year seedlings was 5s. per 1000, and 1-year seedling and 1-year transplanted 15s. per 1000; plants in pots 6 to 9 inches, 6s. per dozen; 12 to 18 inches, 1s. 6d. each. In 1860 the price of 1-year seedlings was 6s. per 1000, and 1-year seedlings and 1-year transplanted 20s. per 1000; plants 6 to 9 inches, 8s. per dozen; 12 to 18 inches, 2s. each. In 1868 the price of 1-year seedlings was 5s. per 1000; 1-year seedling and 1-year transplanted, 17s. 6d. per 1000. Seed cost in 1850 45s. per cwt.; in 1860, 50s.; in 1868, 36s. per cwt.

PINUS PORPHYROCARPA

Specific Character.—Strobi et monticolæ simillima, differt foliis latioribus, stomatum seriebus septem vel octo, strobilis purpureis, apophysi corrugato vix opaco minus convexo, seminibus dorso nigro-brunneo maculatis.

Habitat in Oregon et California.

This species has hitherto been confounded with *Pinus monticola*. But it differs from that species in the following particulars. The leaves (fig. 1) are broader, and are much more thickly supplied with stomata (fig. 2). *P. monticola* has usually only three or four rows of stomata, on each of the two inner sides of the leaf. This species has seven or eight: they are also more silvery, and give the foliage a more glaucous hue. The male catkins (fig. 3) and the anthers (fig. 4, *a b*) and female catkins (fig. 5, *a, b, c*), bright carmine purple, scarcely differ from those of that species. The cones, however, instead of being pale (white at first and chesnut-coloured afterwards), are purple. The scales (fig. 6, *a b*) are not so convex; the apophysis is more corrugated, and it has not the velvety opaque appearance of *P. monticola*. It has more the appearance of *P. Strobus*, which has a slight lustre. The wing of the seed is more hatchet-



shaped (fig. 7, *a b*); and the seed itself (fig. 8, *a b*), instead of being concolorous, is on one side marked with black, while the other side, over which the wing extends, is slightly streaked as in *P. monticola*.

The chief, or at least the most obvious, distinction in this species is the colour of the cone—purple instead of yellow or chesnut. Had it, however, differed in no other respect, we should not have recorded it as anything more than a variety; but as this character is accompanied with the others above mentioned, and the characters have been reproduced in young plants raised from the seed of this kind, we have thought it best to secure its recognition by describing it under a distinct name.

PINUS PORPHYROCARPA

Description.—The trees are said to be readily distinguishable from *P. monticola* by their darker and more glaucous foliage; and the crowded rows of stomata in the leaf enable any one to distinguish the young plant without difficulty.

Geographical Distribution.—We know nothing of this further than that the plant has come from the same districts as the true *P. monticola*.

History.—Our attention was first directed to this species by Mr. Thomas Patton of Glenalmond, who informed us that he had two kinds of *P. monticola*, one producing white cones, and the other purple cones. We then remembered that Loudon said something about red cones; and on referring to his work, we found that in describing *P. monticola* he mentioned that “among Douglas’ specimens there is a variety with red cones from which no plants have yet been raised.” This is doubtless the purple-coned species which we now describe. Mr. Patton has been kind enough to send us specimens of the different parts of the tree, from which the foregoing figures have been taken.

Properties and Uses.—Yet to be discovered. No doubt the same as those of the true *P. monticola*.

Culture.—Not different from that of *P. monticola*.

Commercial Statistics.—Not yet in the trade; but as—if our view is correct—the species can be easily recognised, even in the young state, by subjecting the leaves to examination with a lens, the reader has it in his power to supply himself by visiting the nursery grounds and scrutinising the plants for himself. If we are right, he can supply himself with plants at the price of *P. monticola*. If we are wrong, he is no loser, for he then only gets what he pays for.



PINUS SABINIANA.

IDENTIFICATION.—PINUS SABINIANA (Douglas MSS.). Lambert, *Genus Pinus*, ed. 2, ii. p. 146 (1837-8). Loudon, *Arboretum*, iv. p. 2246 (1838). Forbes, *Pinct. Woburn.*, p. 63 (1839). Antoine, *Conif.*, p. 30 (1840-46). Link, in *Linnaea*, xv. p. 509 (1841). Loudon, *Encycl. of Trees*, p. 982 (1842). Spach, *Hist. Nat. Vég. Phaner.*, xi. p. 390 (1842). De Chambray, *Traité Prat. Arb. Rés. Conif.*, p. 347 (1845). Endlicher, *Syn. Conif.*, p. 159 (1847). Lindley and Gordon, in *Journ. Hort. Soc.*, v. p. 316 (1850). Knight, *Syn. Conif.*, p. 30 (1850). *Flore des Serres*, ix. p. 275 (1854). Carrière, *Traité Gén. des Conif.*, p. 334 (1855). Gordon, *Pinctum*, p. 208 (1858).

NUT PINE and DIGGER PINE of the Californian settlers.

ENGRAVINGS.—Cones, Leaves, &c.—Lambert, *loc. cit.*, t. 58. Loudon, *Arboretum*, *loc. cit.*, figs. 2138-2143. Loudon, *Encycl. of Trees*, *loc. cit.*, figs. 1834-1838. Forbes, *Pinct. Woburn.*, *loc. cit.*, t. 23-24. Antoine, *loc. cit.*, t. 11. *Flore des Serres*, *loc. cit.*

Specific Character.—Pinus foliis ternis quaternisque elongatis tenuibus, vaginis laceris longis: strobilis magnis pyramidato-ovatis, squamis connatis apophysi ancipiti umbone valido elongato fubulato uncinato incurvo acuto, feminibus alæ longitudine.

A large tree, reaching about 100 feet in height. Trunk straight; bark ash-grey, not very thick. Branches straggling and bent, with leaves only at the terminations, which bear a double tuft of long leaves hanging heavily down; consequently the tree usually looks bare and unfurnished. Leaves in threes, persistent for only two years, glaucous, from 10 to 12 inches long, sharp-pointed, strong, but not so much so as in *P. macrocarpa*—twisted, three-sided, rounded on the outer side, and with a prominent midrib on the inner, which, as well as the lateral margins, are strongly serrated: with from 10 to 12 rows of stomata on the outer rounded side [fig. 1], and from 4 to 6 on each side of the midrib [fig. 2].



Fig. 3.



Fig. 1.



Fig. 2.

Sheaths [fig. 3] from 1 to 1½ inches long and light brown when young, but shortened, wrinkled, and grey when old. At the base on the outside of each, when young, is a long scale with a shorter one on each side of it. Terminal buds elongated, peaked, bearing about six rows of leaf-buds spirally disposed; the base or stalk, which lengthens with its growth, not bearing leaves, but merely scales, so that the twig of a year's growth would be bare but for a tuft of long leaves at its apex, each branch thus shewing two tufts of long leaves at a distance from each other. The phyllulæ left by the fall of the leaves are small and distant from each other, and with very slight decurrent scars. Male catkins, appearing in their native country in February and March, in Europe in May; erect, alternate, and clustered round the young buds; whitish, cylindrical, and obtuse; about an inch in length and ¼ of an inch in diameter. Cones subverticillate, growing at the extremity of last year's shoots, from 8 to 10 inches long, and 6 or 7 inches in diameter, slightly more developed on the outer than the inner side; of a bright green when young, fawn-coloured or brown when old; at first erect, afterwards pendent, surrounding the stem in clusters of from three to nine, which press on it for support, and remain on the tree for several years; very resinous; footstalks 2 or 3 inches long; scales hard and strong, fully 2 inches long and 1¼ broad; apophysis projecting, pyramidal, compressed transversely, flattest on the inner side, almost

sharp on the sides, the umbo or protuberance developed into a solid point, which is frequently recurved like a hook, particularly in the basal scales, and then confounded with the apophysis itself. Seeds nearly an inch long, half-an-inch broad, oblong-ovate, flattened on the inside; test dark-brown, hard and crustaceous; kernel good to eat, of an agreeable nutty flavour; seed-wing varying in length, but usually as long as the seed. Cotyledons 10 to 12 in number.

Description.—Speaking of this species and of its ally, *P. Coulteri*, Loudon says that “they may be described as of surpassing beauty.” This opinion will scarcely be endorsed by those who have seen the plants in their present state of advancement in this country, nor does it appear to be entertained by those who have seen them in their native forests. On the contrary, their mode of growth, which is straggling and irregular, combined with their scanty clothing, has caused them rather to be viewed with disfavour. There is, however, one point in their appearance which has a certain charm when seen in their native forests, namely, the colour of the foliage, which is of a hazy blue, and makes them readily distinguishable from other Pines at a great distance. The traveller in California, when he sees the sides of the hills of the distant landscape looming of this peculiar hue, can tell that they are clothed with this tree as surely as we can indicate the wild Birch from its misty grey in our own Highlands. Loudon says that the trees are of a tapering form, straight, and of regular growth, from 40 feet to 120 feet in height (Douglas says 140), with trunks from 2 to 12 feet in circumference. This description scarcely applies to the majority of these trees. Straight and tapering trees are no doubt often met with. Two such (which may still survive) were left standing in the village of Shasta, in Upper California, on account of their unusual size and beauty; but the majority of the trees in their native forests are irregularly shaped and straggling. In their young state in this country, they are at first, until the branches extend, sufficiently handsome, the long leaves on the short branches being sufficient to clothe the trunk; but when the branches grow longer and leave large spaces unfilled up, the two years’ leaves at their end are insufficient to cover it, and the trees look poor, tufty, and thinly clad.

The magnificent cones, however, are amply sufficient to atone for any such defects. A tree bearing numbers of these extraordinary fruits must always be an object of interest. An early explorer of the wilds of California speaks of his party camping for the night in a grove of these trees, and after having lighted their fire under one, and composed themselves to rest, being awakened by the wind rising and sending the giant cones tumbling about their ears. To escape injury, they had to take to their heels, and remake their camp out of reach of such a bombardment.

It is sometimes called the Digger Pine by the Americans, on account of the seeds being used as food by the Digger Indians; but is more generally known as the Nut Pine, in consequence of the seeds being used as nuts, and having something of their flavour.

History.—This species was first found by Douglas in 1826; but his specimens, along with the notes which he had made, were lost in crossing a rapid stream on his way northwards. It was not until 1831 that he again met with it. He then sent a detailed account of it for publication in the Horticultural Society’s *Transactions*, but unfortunately this account was never received. The cones, seeds, and specimens which he sent, however, arrived in safety in 1832, and from these seeds were reared the oldest specimens of the trees now in this country. One of these still stands in the Horticultural Society’s Arboretum at Chiswick. It was first described by Lambert, and was named by him *Sabiniana*, in accordance with the MSS. name given to it by Douglas. It was so named by him in compliment to Mr Sabine, then Secretary of the Horticultural Society of London, to whom Douglas considered himself under obligations, which his generous nature felt so strongly, that when, in consequence of a domestic revolution in the affairs of the Horticultural Society, Mr Sabine resigned the office of Secretary, Douglas, from the opposite side of the globe, followed his example, and resigned his appointment as Plant Collector to the Society. He still, however, intended to send his collections and notes to the Society; and a few (among which were the

PINUS SABINIANA.

3

the confinement of the cones and seeds of this tree) were received; but his distressing death unhappily brought all such contributions to a premature end.

Mr Sabine was well known in London as a lover of science, as his brother General Sabine continues to be. He was a Fellow of the Linnæan Society, as well as of many other learned Societies. For some time he was upon the Council of the Linnæan Society; and for many years he filled the office of Secretary to the Horticultural Society. He contributed about forty botanical or horticultural papers to the *Transactions* of the Horticultural Society, as well as several papers to the Linnæan. He was also an authority on ornithology, and had especially directed his attention to the changes in the plumage of birds. He described a new gull from Greenland, and wrote an account of the marmots of North America. He also wrote the Zoological Appendix to Captain Franklin's Journey of 1819-22. The revolution in the affairs of the Society which led to the resignation of Mr Sabine, and of several members of the Council, arose from the dissatisfaction of a portion of the Society with its financial management; but during Mr Sabine's Secretaryship an immense amount of good was done to horticulture, of which not only this country but the whole of Europe feel the advantage to the present day. It was while he was Secretary that Douglas's discoveries were made, and his name must ever be associated with the most useful period of the Horticultural Society's existence.

Geographical Distribution.—This species is found on the lower slopes of both the coast and inland ranges of mountains in California, for nearly the whole length of the state, or at least from Santo Lucia to Oregon. In ascending from the plains, it is among the first of the Pines which is met with, and continues through the range of *Pinus tuberculata* and *P. Benthamiana*, disappearing about the lower limits of the Sugar Pine (*P. Lambertiana*).

Groves or forests of this tree may be easily reached from San Francisco. If the explorer chooses to turn his face southwards, he will find them before reaching Santa Cruz; if to the east, he will meet them before he reaches Coloma, the name now given to Sutter's Mill, where the discovery of gold was first made, which has since peopled the wildernesses with such astonishing rapidity; and to the north, in the lower mountains of the Sierra Nevada, at almost any point he pleases.

Properties and Uses.—The timber, although white and tough, is not of much value, the habit of the tree making it unprofitable to work from its crooked and irregular form. Carrière says that, contrary to the opinion given by Lambert as to the bad quality of the wood, M. Bourrière de la Rivière assured him that it is tenacious, flexible, although resisting, and consequently very fit for carpentry; but that "it presents, in the spiral disposition of its fibres, a structure which renders its employment difficult for certain purposes, for it will not split without much difficulty." We do not exactly know what this means, as the spiral disposition of the fibres is a property shared by all other Pines as well as all other plants; but we have seen in the timber of well-grown trees in this country large accumulations of resin irregularly dispersed among the woody fibres, which doubtless will account better than its spiral fibres for the unworkable character of the timber.

Culture.—It vegetates freely in the open air, and a seed-bed of this tree bursting through the ground is an exceedingly pleasing object—the cotyledonous leaves coming up so strong, so fresh, and so green, as to charm any one who is watching them. They require protection during the winter, however, for the first year or two. As a baby cannot stand the exposure which would not prove injurious to a grown man, so young plants are more tender than those further advanced. Mr Palmer's tables of the injury done in the winter of 1860 shew that in England the plants at twenty-four out of thirty-nine localities had been killed, and had escaped uninjured at only ten—that is, a fourth had escaped. In Scotland, the proportion was higher—a half had escaped; and in Ireland the whole escaped, but then only one locality was reported on. The soil in which the tree grows in its native country is

very various, as may be supposed from the great range of its habitat; but good rich loam, such as is found well adapted for the *Rosaceæ*, will, in general, be found to answer for it.

It has been widely although not very largely introduced into Europe. In the museum-collection of the Royal Horticultural Society, a mature cone of this tree is preserved, which was obtained, by Lieut.-Col. Wright Hudson, from a tree at Simferopol in the Crimea during the Crimean war, and presented by him to the Society. If grown from the seeds introduced by Douglas, the climate of the Crimea must be more favourable to its growth than that of Britain, as none of the trees grown in this country have yet produced fruit. M. Carrière, in his *Traité Général des Conifères*, says that the trees which grow in the Jardin des Plantes, and which are the largest that he knew of, have produced male catkins, but no cones. The height of the trees of which he speaks was, in 1858, about 18 feet, and they were about thirteen years old. The tree above noticed, which was raised at Chifwick from the seeds sent by Douglas, is now 40 feet high; one at Rolleston Hall, Staffordshire, which was 46 feet high, is mentioned by Mr Palmer as having been killed in 1860.

Commercial Statistics.—Price of seeds in 1859, per 100, 40s.; in 1865, 12s. to 25s. per 100. Young plants, in 1852, 6 to 12 inches, 7s. 6d. each; 12 to 18 inches, 10s. 6d.; 4 to 5 feet, 21s. In 1857, 1 year seedlings, 1s. 6d. each; 2 years, 2s. 6d.; specimen plants, 4 to 5 feet, 10s. to 15s. each. In 1861, 1 year seedlings, 2s. 6d. each; 6 to 9 inches, 3s. 6d.; 18 inches to 2 feet, 7s. 6d. to 10s. 6d. In 1865, young plants, 6 to 12 inches, 1s. 6d. each; 12 to 18 inches, 2s. 6d. each.



PINUS TAEDA, Mill.

Pinus taeda L. var. taeda (L.) Mill. & K. Johnson & Johnson

PINUS TÆDA.

ANGLO-AMERICAN NAMES.—LOBLOLLY PINE; FRANKINCENSE PINE; OLD FIELD PINE; and WHITE PINE, about Richmond and Petersburg, in Virginia.

IDENTIFICATION.—PINUS VIRGINIANA TENUIFOLIA, Plukenett, *Almag. Bot. Phyt.*, p. 297 (1696).

PINUS FOLIIS LONGISSIMIS, Colden, *Nov. Ebor.* in *Act. Soc. Upsal.*, p. 1743, n. 230.

PINUS FOLIIS TERNIS, Gronovius, *Flor. Virgin.*, ed. 2, p. 152 (1762).

PINUS TÆDA, Linnaeus, *Spec.*, p. 1419 (1762); Du Roi, *Harbk. Baumz.*, ii. p. 63 (1771); Wangenheim, *Beytr.*, p. 41 (1787); Lambert, *Genus Pinus*, ed. 1, i. p. 23 (1803); Desfontaines, *Hist. Arb.*, ii. p. 612 (1809); Michaux fils, *Arbres For. de L'Amer.*, i. p. 97 (1810); Aiton, *Hort. Kew.*, iii. p. 368 (1810); Willdenow, *Baumz.*, p. 269 (1811); Loiseleur, *Nouv. Duham.*, v. p. 245 (1819); Lawfon, *Agric. Manual*, p. 351 (1836); Lambert, *Genus Pinus*, ed. 2, i. p. 30 (1837); Loudon, *Arbor. Brit.*, iv. p. 2237 (1838); Forbes, *Pinet. Woburn.*, p. 43 (1839); Antoine, *Conif.*, p. 25 (1840); Link, in *Linnaea*, xv. p. 503 (1841); Loudon, *Encycl. of Trees*, p. 976 (1842); Spach, *Hist. Nat. Vég. Phaner.*, xi. p. 391 (1842); Endlicher, *Syn. Conif.*, p. 164 (1847); Lindley and Gordon, in *Journ. Hort. Soc.*, v. p. 217 (1850); Knight, *Syn. Conif.*, p. 30 (1850); Lawfon, *Abietineae*, p. 34 (1851); Gordon, *Pinetum*, p. 210 (1858); and *Supplément*, p. 67 (1862); Orsted, *Frilands-Trævæxten i Danmark*, part 1, p. 77 (1864).

ENGRAVINGS.—Cones, Leaves, &c.—Lambert, *Genus Pinus*, ed. 2 (*loc. cit.*), t. 18; Loudon, *Arbor. Brit.* (*loc. cit.*), figs. 2188-2122; Loudon, *Encycl. of Trees* (*loc. cit.*), figs. 1816-1819; Loiseleur, *Nouv. Duham.* (*loc. cit.*), t. 75, fig. 2; Forbes, *Pinet. Woburn.* (*loc. cit.*), t. 14; Antoine, *Conif.* (*loc. cit.*), t. 7, fig. 1; Michaux fils, *Arbres For. de L'Amer.* (*loc. cit.*), t. 9. Trees.—Loudon, *Arbor. Brit.*, (*loc. cit.*), iv. fig. 2122 and viii. t. 83.

Specific Character.—Pinus foliis ternis elongatis tenuibus, strobilis patentibus ovato-oblongis obtusis, squamarum apophysi compresso-pyramidata recta, umbone projiciente uncinato, feminibus parvis ala longa.

Habitat in Florida et Virginia.

A tree of about 80 feet in height, with a spreading top. Bark yellowish or ash-grey, at first smooth; when older, thick and deeply split. Buds short, somewhat cylin-

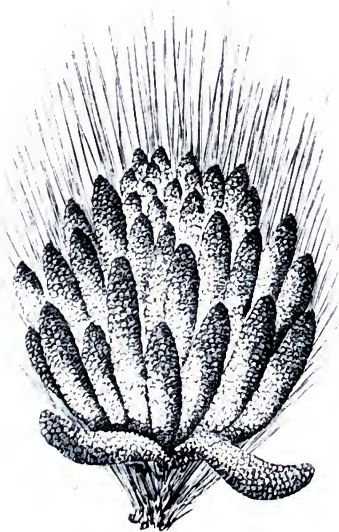


Fig. 4.

drical and conical at the apex (in young plants half an inch long, and quarter of an inch broad, [fig. 1]), brownish red, very resinous. Leaves of a light green, slender, from four to five or five and a half inches in length, with the margins slightly serrated, trigonal, rather rigid, with eight or nine rows of fine stomata on the back, and from three to five rows on each other side [figs. 2 and 3]; usually three in a sheath, sometimes four. Sheaths of the leaves brown, rather fine, and long, nearly an inch in length. Male flowers, about an inch long, bent, and intermingled [fig. 4]. Anthers [figs. 5 and 6] with the crest moderately large, and the margin



Fig. 1.

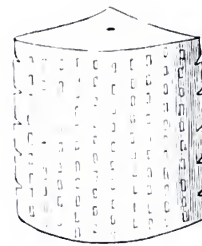


Fig. 2.



Fig. 3.



Fig. 5.



Fig. 6.



Fig. 7.

only very slightly lacinated. The cones are elongated and sub-cylindrico-pyramidal when closed: when open, more or less rhomboidal, slightly bent towards the tip, from three and a half to four and a half inches long, and from one and three-quarters to two inches

in diameter. Scales [fig. 7] long and rather narrow, the fides sinuate, apophysis rhomboidal or pentagonal, with a transverse line or impression, slightly depressed towards the centre, in which there is a narrow sub-pyramidal transverse umbo, about two lines in its largest (transverse) diameter, and armed with a short, strong, sharp, and hard, slightly curved prickly or spine, projecting outwards and forwards, about a line in length. The seeds are small, but the wing is disproportionately long, being an inch or even nearly an inch and a half in length [fig. 8].



Fig. 8.

Lambert figures, under the name of *aloppecuroidea*, the cone of what he considered a variety of this species; and Loudon mentions a plant of it as existing in the Horticultural Society's Garden. It is not there now; but as Loudon considered it not distinct from this species, and as the cone figured is obviously an immature specimen, which, moreover, has been pronounced to be *pungens* by Carrière, *serotina* by Pursh, and *rigida* by someone else, we may be excused from taking further note of the variety.

Description.—Lambert, on the authority of Wangenheim, says this is a low tree (*arbor humilis*), full of branches, and attaining but moderate strength. This is a mistake, as is pointed out by Michaux, who says that, on the contrary, it is, next to the White Pine (*P. strobus*), the tallest tree of its genus in the United States. Even already, in this country, it has reached a height of 80 feet. Its diameter rarely exceeds two or three feet. It has a wide-spreading summit. Its foliage is open, of a fine light green, and the leaves rather long and tufted. The cones are green in their youth, and of a darkish olive brown when ripe. The bark is rather light in hue, and, when old, becomes deeply corrugated and split. The bloom takes place in the beginning of April, not the latter end of August, as was said by Lambert, apparently on the authority of Wangenheim, who must have meant the cones which fall from the trees in the first year, as soon as they are ripe: in this respect differing from some of the species allied to it, such as *Pinus rigida*, *P. tuberculata*, &c., in which the cones (as indeed is the case with most of the three-leaved Pines) adhere to the tree for a longer period, sometimes for many years.

Geographical Distribution.—The range of this species extends with intermissions throughout the south-eastern provinces of North America, commencing at the north of Virginia, and extending southwards into Florida. Wangenheim, and after him Lambert, says that it is found in Pennsylvania. It no doubt was so when the former wrote (1787), but it is not so now. Michaux notes this, and remarks that the most northerly point where he observed it was near the now classic military ground of Fredericksburg, 230 miles south of Philadelphia.

It grows nowhere continuously, however, a barren sandy soil being what it prefers. As stated by Michaux, it grows in the lower part of Virginia, and in the districts of North Carolina, situated north-east of the river Cape Fear, over an extent of nearly 200 miles, where the soil is dry and sandy. On spots consisting of red clay mingled with gravel, it is supplanted by the Yellow Pine, and by different varieties of Oak. The two Pines are regularly alternated according to the variations of the soil, and frequently vanish and reappear at intervals of four or five miles. These alternations are noticed by Sir Charles Lyell, who ('Travels in North America,' vol. 1. p. 142) tells us that the sands of the "Pine Barrens" on which the long-leaved or Pitch Pines, *Pinus Teda* and *P. palustris*, flourish, are derived from strata of more than one tertiary period; and there are interstratified beds of clay which, whenever they come to the surface in valleys, cause swamps, where peculiar kinds of Evergreen Oaks, the Cypress or Cedar (*Taxodium distichum*), tall canes, and other plants abound. "The Pine Barrens," says he, "retain much of their verdure in winter, and were interesting to me from the uniformity and monotony of their general aspect; for they constitute from their vast extent one of the marked features in the geography of the globe, like the Pampas of South America." They extend in a broad belt many hundred miles in length from New Jersey to Georgia, running parallel to the coast in the region called the Atlantic plain.

In the lower parts of Virginia, this species exclusively occupies lands that have been exhausted by cultivation;

PINUS TÆDA.

3

cultivation; and amid forests of Oak, tracts of 100 or 200 acres are not unfrequently seen covered with thriving young Pines. In the more southern States, it is the most common species after the Long-leaved Pine; but in the "Pine Barrens," according to Michaux, it grows only in the branch swamps, or long narrow marshes that intersect these sterile lands, and near the creeks and rivers, where the soil is of middling fertility and susceptible of improvement, such as the vicinity of Charleston, South Carolina, which is covered to the distance of five or six miles with Loblolly Pines.

According to Pursh, all the woods in the Southern States seem to be seeded with it; for when any piece of clear land is neglected for any length of time, it is speedily covered with this species; and hence its name, among the inhabitants, of Old Field Pine. It is difficult, and in some cases almost impracticable, he adds, to recover the lands which have been overrun with young Pines of this species, as the ground appears to have lost all fertile properties for any other kind of vegetation; or perhaps it may be that the soil is naturally so sterile that nothing but plants suited for such conditions will grow in it.

History.—It is one hundred years since this species was described by Linnæus; and there is no reason to doubt that it was recognized and described by botanists as long as seventy years before that date. It was not, however, brought to this country until 1713, when Bishop Compton introduced it. It is doubtless to that period, or not long after, that the fine specimens at Syon House and Pains Hill are to be referred. One of the latter, Loudon says, is doubtless the handsomest tree of the species in Europe. Others at Kew and Whitton belong to a somewhat later period.

Properties and Uses.—This species is applied only to secondary uses. It decays rapidly when exposed to the air, and is regarded as one of the least valuable of the Pines. Where other timber is not procurable, it is, however, extensively used. Not many years ago, and probably still, the majority of the houses in the north of Virginia (Michaux says three-fourths) were built of the Loblolly Pine, and it is even used, in the absence of the Yellow Pine, for the ground floors; but the boards, although only four inches wide and strongly nailed, shrink and become uneven. This inconvenience is attributable to its spongy consistence, and is not experienced in the Long-leaved Pine (*P. palustris*), whose concentric circles are twelve times as numerous in the same space.

In the ports of the Southern States this species is used, like the Pitch Pine in those of the North, for the pumps of ships. At Charleston the wharfs are built with logs of the Loblolly Pine, consolidated with earth. Bakers consume it in their ovens, and it is sold a third cheaper than the more resinous wood of the Long-leaved Pine.

Michaux mentions that the tallest stocks, which he observed, in proportion to their diameter, were some near Richmond, growing on a light arid soil. From several of them cylinders might have been formed 12 or 15 inches in diameter, and 50 feet in length, perfectly regular and free from knots.

The wood has a still greater proportion of sap than that of the Pond and Pitch Pines, *Pinus serotina* and *P. rigida*. The same author found 30 inches of alburnum, in trunks three feet in diameter, and in those a foot in diameter, and 30 or 35 feet in height, not more than an inch of heart. The concentric circles are widely distant, which is quite in accordance with the rapidity of its growth. In the more southern States, in Virginia, where it vegetates more slowly, its texture is closer, and the proportion of sap-wood less considerable. Michaux particularly observed this at the saw-mills of Petersburg.

As might be expected, from this large proportion of sap-wood, it affords turpentine in abundance, but in a less fluid state than that of the *Pinus palustris*; that tree containing more alburnum, from which the turpentine distils. Perhaps by making deeper incisions it would yield a greater product.

Though little esteemed in America, Michaux suggests that it would be an important addition to the south of Europe, where a tree of fine appearance and rapid vegetation is an invaluable treasure. It might be employed in joinery for objects concealed from sight, for packing-cases, &c. We have little doubt it would grow as rapidly as the Maritime Pine on the plains of Bordeaux.

Cultivation.

Cultivation.—Although a native of a warmer clime, the *Pinus Teda* does not refuse to grow, and even to thrive, in some places in the south of England and north of France; but its success is exceptional, a circumstance which, doubtless, is in part to be ascribed to improper soil and exposure—the barren sandy soil in which it abounds in its native country being comparatively rare in England. It is also no doubt due to this that it does well at Berlin, which is, generally speaking, from that very cause, one of the most unfavourable countries for coniferous plants.

Loudon mentions the dimensions of specimens at Syon House, Pains Hill, Whitton, Kew, and Dropmore, which, when he wrote (in 1837), were respectively 75 feet, 60 to 70 feet, 60 feet, 40 to 50 feet, and 38 feet high. We give below a copy of Loudon's figure of one of the Syon House specimens.

Mr Palmer's tables shew only one place where this species was killed in the severe winter of 1860-61, viz., at Highnam Court, in Gloucestershire; but as he had only reports from six places, the statistics are not of any great value. At the other five places mentioned, which were respectively in Surrey, Bedfordshire, Yorkshire, and Fife, none of the plants of this species were injured.

Commercial Statistics.—Loudon mentions that as seeds are easily procured from New York, the species was not uncommon in London nurseries; and that it was more frequent in collections than most other American plants. Whatever it may have been in his time, it is not so now. Whether from frequent failure or want of appreciation of it, and a consequent bad market, it is by no means common in nurseries or collections; so much so that, as we have just seen, there were only six places in all Britain where Mr Palmer has obtained reports upon it. The present price of young plants under 18 inches high is from 1s. to 1s. 6d. each.



Fig. 9. *Pinus Teda* at Syon House, 75 feet high. Scale, 1 inch to 12 feet.



18. Black Bal.

18. Black Bal.

PINUS TUBERCULATA Mill.

Painted from Spec. of J. & A. Johnson, 1840

PINUS TUBERCULATA.

IDENTIFICATION.—PINUS TUBERCULATA, Don, in *Linn. Trans.*, xvii. p. 442 (1835). Lambert, *Genus Pinus*, iii. (1837). Loudon, *Arboretum*, iv. p. 2270 (1838). Loudon, *Encycl. of Trees*, p. 990 (1842). Antoine, *Conif.*, p. 33 (1840). Endlicher, *Syn. Conif.*, p. 162 (1847). Gordon, in *Journ. Hort. Soc.*, iv. p. 218 (1849). Knight, *Syn. Conif.*, p. 30 (1850). Lindley and Gordon, in *Journ. Hort. Soc.*, v. p. 816 (1850). Carrière, *Traité Gén. des Conif.*, p. 338 (1855). Gordon, *Pinetum*, p. 211 (1858). *Circular by Edinburgh Oregon Botanical Association*, p. 2 (1852). PINUS CALIFORNICA, Hartweg, in *Journ. Hort. Soc.*, ii. p. 189 (1847).

ENGRAVINGS.—*Cones, Leaves, &c.*, Lambert, *Genus Pinus*, loc. cit., t. 85; Loudon, *Arboretum*, loc. cit., fig. 2181; Loudon, *Encycl. of Trees*, loc. cit., fig. 1850; Antoine, *Conif.*, loc. cit., t. 14, fig. 2; Gordon, *Journ. Hort. Soc.*, iv. p. 219; *Circular by Edinburgh Oregon Botanical Association*, loc. cit., Pl. ii., fig. 2.

Specific Character.—P. foliis ternis fat elongatis crassis subtortis, vaginis brevibus; strobilis aggregatis inequilatere sub-conicis; squamarum apophysi elevato-pyramidata quadrangulata, umbone brevi uncinato, feminibus parvis, alis fat longis.

Habitat in California.

A tree of from 25 to 50 feet in height, stem straight. Branches few, thinly and irregularly scattered. Buds* surrounded by imbricated scales, moderate in size and conical [fig. 1]. Leaves in threes, of a light



Fig. 1.

green colour, four or five inches long, twisted, so as to make a turn of an inch and a half from base to tip; stiff, strong, triquetral, rounded on the back, keeled on the inner side; all three margins strongly serrate, bearing eight nearly equally distant rows of stomata on the rounded back, with a slightly wider interval in the middle; and about four on each side of the inner sides (sometimes three, sometimes four, and sometimes three on the one side and four on the other), [figs. 2 and 3]. Sheaths short and small [fig. 4]; dark amber brown where exposed; reddish brown where not exposed; pale at the translucent margins; shorter on the older leaves. Inflorescence not observed. Cones aggregated together in clusters, sessile, growing chiefly on the main stem, from which they stand out

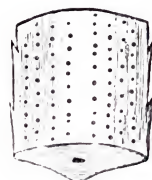


Fig. 2.

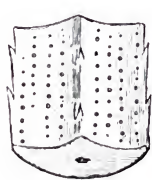


Fig. 3.

nearly at right angles when young, pendent and firmly adpressed to it when old; nearly straight on the inner side, curved on the outer, of an unequal conical shape, varying in length from four to six or even eight inches; hard, glossy, not resinous, fawn-coloured, but losing this colour and becoming darker when old. The cones on the young trees have

the scales on the outer side, particularly towards the base, very prominent, projecting horizontally, conical, and deeply divided from each other, giving occasion to the specific name *tuberculata* [fig. 5]. The cones on the old trees [fig. 6] lose in a great measure the strongly tuberculate form. Scales [fig. 7] wedge-shaped on the outer side, dilated, and quadrangular at the apex, with a short hooked tooth on the umbo, turned towards the tip of the cone; on the inner side smaller and flat; the hooked tooth on their umbo being either absent or a mere prickle. The scales are arranged on a spiral



Fig. 4.

of

* The bud is not correctly drawn in the coloured plate, and is therefore reproduced in this place.

of eight rows. Endlicher, *loc. cit.*, says, that each cone contains fifteen or sixteen rows of scales; but this is reckoning the same row twice, when, starting from the base, it has made the circuit of the cone and

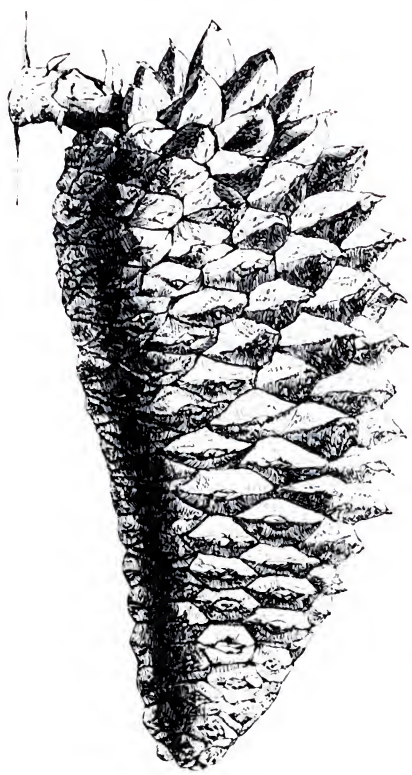


Fig. 5.

reappeared at the tip. Within each scale are two seeds, of which the wings are about half an inch in length [figs. 8 to 13]; the back of the wing is straight, the front rounded and deeply emarginate at the base near the seed; it is light brown with darker striae of varying breadth. The seeds themselves are small for the size of the cone, light brown speckled with dark brown.

Hartweg nowhere speaks of his having met with *Pinus tuberculata*, although he travelled through the district where it is found; but he met with it nevertheless, and gives the following account of it under the name of *P.*

Californica. He says, "Another kind of pine that I found within a few hundred yards of the foregoing species (*Pinus Benthamiana*), is probably the doubtful and little known *Pinus Californica*. The trees seem to be of slow growth, and do not attain any great height, seldom more than 25 feet, by 8 inches in diameter.

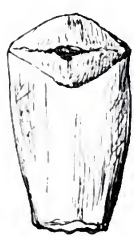


Fig. 7.

The leaves are in bundles of three, $4\frac{1}{2}$ inches long; cones 5 to $5\frac{1}{2}$ inches long by 2 broad; the outer surface curved, the inner straight; scales on the outer surface more developed, inclosing two small flat-winged seeds.

The cones are only produced on the main stem; when ripe they are of a light brown colour, and stand off at nearly a right angle; when old of a silvery grey, pressing firmly upon the stem, and remain on the trees for a series of years without opening or shedding their seeds." (*Journ. Hort. Soc.*, ii. p. 189.) This, it will be seen, is a very exact description of *P. tuberculata*, and any doubt as to its identity is removed by Mr Hartweg having sent specimens home, which were identified and figured by Mr Gordon in the *Journal of the Royal Horticultural Society*, vol. iv. p. 219.

"The doubtful and little known *Pinus Californica*" will probably continue doubtful and little known until its name is erased

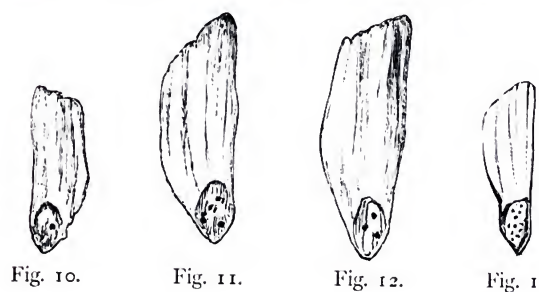


Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

from our books altogether; and the sooner this is done the better. It probably would have been done ere now had it not been a legacy of La Perouse, possessing a special interest, particularly to the French, from being the only plant (if we may trust Loudon) that has been preserved of those sent home by the expedition under the command of that unfortunate navigator. In 1786 or 1787 he touched at Monterey, and Collignon (named Colladon by Loudon), who was gardener (or, as we should call it now, botanist or botanical collector) to the expedition, collected some cones of a pine or pines growing in the neighbourhood of that place, one of which was sent to the Museum of Natural History at Paris. From this cone the following description was drawn up by Professor Thouin, and afterwards published by Loiseleur in the *Nouveau Duhamel*, vol. v. p. 243, viz., "Leaves in twos or threes, slender. Cones much longer than the

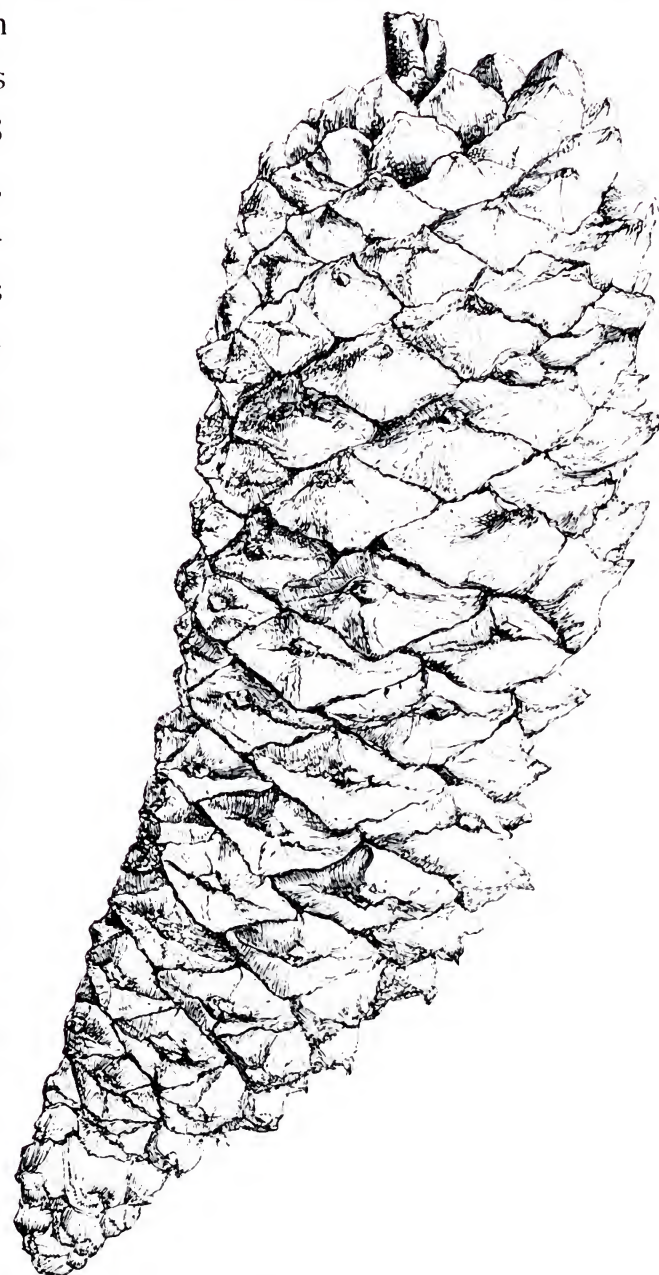


Fig. 6.

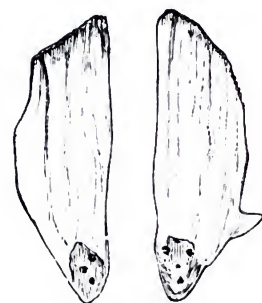


Fig. 8.

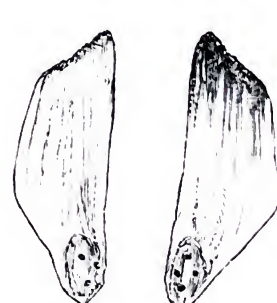


Fig. 9.

PINUS TUBERCULATA.

3

the leaves. . . . The cone had the form of the great maritime pine (*Pinus pinaster*), but a third longer in all its dimensions. Under each of its scales two seeds are found of the size of those of *P. Cembra*, the kernel of which is good to eat." No figure of the cone is given, and the cone itself disappeared from the Museum about the year 1814. So far as La Perouse or Collignon's specimen itself is concerned, therefore, we are confined to the above description. Now, by this time we know pretty well all the pines that are found in the immediate neighbourhood of Monterey; and the only species with "leaves in twos or threes" which have seeds which can be compared in size to those of *Pinus Cembra*, and of which the kernel is good to eat, are *Pinus Sabiniana* and *P. Coulteri*. No doubt the seeds of both of these species are larger than those of *P. Cembra*, and have wings, which *P. Cembra* has not; but Collignon speaking from recollection might have forgot their exact size. They were and are used as an article of food or dessert at the Mission, and by the settlers as well as by the natives; and it is natural that he should remember this feature in the character of the species. But if he really ever got or saw a specimen of the cone of *P. Coulteri* or *P. Sabiniana*, it is by no means natural, it is perfectly incomprehensible—we should almost say perfectly impossible—that he could have passed it over without noticing its wonderful form, size, and great hooked scales. It is equally out of the question that Thouin, describing from the cone itself, should have overlooked them; and not only so, but that he should have described it as of the form of, but a third longer and larger than, *P. pinaster*. Our belief is that Collignon never collected the specimens himself at all, but, tasting the seeds at the Mission or elsewhere, he expressed a desire to get specimens of the cone. The men he employed to get these, instead of going to the more distant second range on which they are chiefly to be found, would take the cones which were nearest to their hand; and as the cones of all the pines growing there are very impenetrably sealed up and difficult to open even when mature, it is not likely that he would be at the trouble of breaking them up (which, besides, would spoil the specimen), and so discover the imposture. Putting out of view the edible kernels, there are several three-leaved pines which grow in the neighbourhood of Monterey which would answer Thouin's description well enough. A cone like, but a third larger than, that of *P. pinaster* might apply equally well either to the present species or to *P. insignis* or to *P. Benthamiana*, and, so far as that character goes, we remain in as great obscurity as ever.

Loiseleur informs us, however, that the seeds of Collignon's cone had been sown at the Jardin des Plantes, and that twelve plants had been raised from them, which, cultivated in the Orangery, had succeeded very well. Most of these plants were afterwards sent to botanic gardens in the south of France, but several remained in the Jardin des Plantes, of which one still survived in 1812 (when Loiseleur wrote), and it had reached the height of 7 feet. This plant furnished him with some information as to the leaves. It may have been it which enabled him to say that the cone was much longer than the leaves. He informs us that the leaves are 3 inches in length; and, reckoning the cones of *P. pinaster* at from 4 to 6 inches long, and adding a third to bring it up to Thouin's requirements, we would have the cones from 7 to 8 inches long as against the leaves 3 inches long—a difference which would fairly entitle him to say that the cones were "much longer." The leaves, he says, were very slender and of a deep green, which is probably the feature on the strength of which "it is now generally admitted that *P. Californica* (Loisel.) and *P. adunca* (Bosc) are synonyms of *P. insignis* (Dougl.)," if Carrière be correct in saying that this is generally admitted nowadays. *P. adunca* is a manuscript name of Bosc, quoted in the *Bon Jardinier* as a synonym of Loiseleur's *P. Californica*, and need not be considered.

Of the twelve plants raised from Collignon's specimen, we learn from Loudon, on the authority of M. Vilmorin, that one found its way into the nursery of M. Godefroy at Ville d'Avray, near Paris; and when Loudon wrote his *Arboretum* (1838), it was the only one which remained alive, those in the Jardin des Plantes having all died. Loudon mentions incidentally that Godefroy's plant was protected every winter, while those in the Jardin des Plantes were planted in the open ground. M. Godefroy manufactured a good many young plants from this individual by inarching, and sent them out under the name of *Pinus Montereyensis* (turned into *Montheragenensis* in the Horticultural Society's garden at Chiswick for the sake of Latinity, and quoted under that name by Loudon). The Horticultural Society got one specimen,

regarding which Loudon mentions the following particulars. "The plant in the Horticultural Society's garden, named there *P. Montheragenfis*, which was received from M. Godefroy about 1829, forms a stunted bush 3 feet high and 4 or 5 feet broad. It is a grafted plant, and its stunted appearance may be chiefly owing to the scion having swelled to a much greater thickness than the stock, and to the buds having been destroyed by insects for several years past. The buds are small, about 2-8ths of an inch long, blunt-pointed, about 3-16ths of an inch broad, brown, and covered with resin. The leaves are chiefly three in a sheath, and from 2 inches to 3 inches long, with short black sheaths." (*Arboretum*, iv. p. 2269.)

The buds here correspond with none of the species we have been speaking of, and we may be permitted to doubt whether they were not abnormally small in consequence of the injuries they had sustained in previous years. We have been unable to find any trace of this plant now in the Royal Horticultural Society's garden at Chiswick.

To pursue the synonymy of *P. Californica*, however, we find that it passed without alteration through the hands of Antoine (his work as a rule containing neither new matter nor new ideas); but when we reach Endlicher (1847), we find it complicated by a description of a species, *P. Sinclairii*, which had in the meantime (1841) appeared in Hooker and Walker-Arnett's *Botany of Captain Beechey's Voyage in the Blossom*. These gentlemen remark that that species may prove to be the *P. Californica* of Loiseleur, but say that the description of it is too incomplete to allow them to decide; and Endlicher adopts their suggestion or arrives at it on considerations of his own. Having come to that conclusion he wholly abandons Loiseleur's imperfect description, and without a word of caution or notice (which we find not well done in any one, but least of all in such an eminent man as Endlicher) he adopts Hooker and Arnett's description of *P. Sinclairii*, merely condensing it a little, and gives their locality verbatim. Here are the parallel passages proving what we say:—

HOOKE AND ARNETT, 'BOTANY OF BEECHEY'S VOYAGE IN THE BLOSSOM.'

Pinus Sinclairii; foliis ternis acicularibus elongatis gracilibus, supra canaliculatis dorso convexis, margine asperis, strobilis basi obliquis pedalis oblongis, squamis elongatis cuneatis apicibus crassius elevato-tetragonis, centro tuberculo spinuloso uncinato instructis.

This covers the hills from Monterey to Carmelo and to Punta Pinos.

ENDLICHER'S 'SYNOPSIS CONIFERARIUM,' p. 162.

Taeda foliis ternis elongatis gracilibus, strobilis (pedalibus) oblongis obliquis apophysi elevato pyramidata tetragona umbone brevi uncinato.

Habitat in California in collibus a Monterey ad Carmelo et ad Punta Pinos.

But whilst we object to this mode of treating synonymy, we must also demur to the justness of the conclusion itself at which Endlicher arrived. Loiseleur gives the size of the cone of *Pinus Californica* as a third larger than that of *P. pinaster*. Hooker and Arnett's description of *P. Sinclairii* makes it nearly three times that of *P. pinaster*. It may be that Endlicher has speculated upon Loiseleur having made a mistake and said a third when he meant to have said three times, and thought that by correcting this mistake everything would be reconciled. But if any such idea influenced him he should have said so. If not, the difference in size remains unaccounted for; and it seems too great even for the startling difference in the dimensions, both of cones and leaves, which we do occasionally meet with both in Californian and Mexican species of Conifers.

Lindley and Gordon's suggestion (*Journ. Hort. Soc.*, v. p. 816) that *P. Sinclairii* is synonymous with Hartweg's *P. Benthamiana* finds more favour in our eyes. The figure of the cone given by Hooker and Arnett is so surprisingly similar as to be almost identical with that of Hartweg's species given by Gordon (*Journ. Hort. Soc.*, iv. p. 213), except in the size, which is nearly double. On the other hand, the leaves of *P. Benthamiana*, as figured, are much larger than those of *P. Sinclairii*.

The last author who has given an opinion on the subject is Carrière, who, rejecting Lindley and Gordon's supposition, considers that "*Pinus Californica* (Loisel.), *adunca* (Bosc), *Sinclairiana* [mistake for *Sinclairii*] (Hooker), and *Coulteri* (Don), may all be only one and the same species." In support of this view he observes, "The cone of *P. Sinclairiana* [*Sinclairii*], figured by Sir William Hooker, appears to me very near, both in size and form, that of *P. Coulteri* (Don), although the apophysis of the scales be less projecting

PINUS TUBERCULATA.

5

projecting; the protuberance, in place of being very much prolonged and recurved towards the summit of the cone, be much shorter; and although, in fine, the leaves be in twos, while those of *P. Coulteri* are in threes."

That M. Carrière is wrong in the last of his premises need not affect our opinion of the judgment which he deduces from them, nor of his qualifications to form one at all. It will be sufficient to remind the reader that the great projecting curved hooks on the scales of the cone of *P. Coulteri* are more than two inches in length and stout in proportion, while the figure of *P. Sinclairii* shews a protuberance of scarcely more than as many lines. To our eyes, too, the form of the cone is wholly different, and the size materially different. We had given M. Carrière considerable credit for his *Traité Général des Conifères* until we came upon this unguarded statement. We still think it a work of considerable merit as a compilation, and we have no reason to doubt the accuracy of anything but his judgment. We regret, however, to find such striking evidence of carelessness in a work of this kind, the value of which depends wholly upon the accuracy of its descriptions.

We have said enough to shew that no certain conclusion can be arrived at regarding the identity of *Pinus Californica*. Correct and expurgate the text as we may, it still remains doubtful to what species it should be referred. The proper course should be to delete the name from the list of species altogether. If, for the sake of the interest attached to it on account of La Perouse, it be still associated with some species as a synonym, more cannot be asked, and more should not be given. We feel inclined to give the preference to *P. insignis*, as the species which should be so distinguished.

Description.—Don says that this tree reaches 100 feet in height. That is a mistake. It is of no great size either in height or diameter, seldom reaching the half of that magnitude. It is generally a straight tapering tree, with regularly-disposed branches. While young it is pretty, with a cheerful green foliage. It begins to bear cones at a very early age (before it is ten feet high), which at first are only produced on the main stem. The cones adhere to the tree for a long time. Jeffrey found trees with as many as twenty whorls of cones on the trunk, the growth of as many years; and the branches were covered with cones in the same way as the trunk. Murray (MSS.) mentions having plucked, from the stem of a tree nearly a foot in diameter, an old cone growing within reach of his hand. It must, of course, have been of great age, and was nearly decayed. As the tree grows older, the branches as well as the leading shoot begin to bear cones; and as they do not fall off, but may be seen rotting on the stem and branches, even when the tree has a girth of three feet, the appearance of the tree is then very peculiar: it seems literally covered with fruit. The contrast between the old and young cones is very great. Those given in figs. 5 and 6 are scarcely recognisable as belonging to the same species; but both were plucked from the same tree by Murray. As the foliage is thin, the tree cannot be called handsome. The timber is said by Gordon to be red and hard. Our information is, that it is white.

Geographical Distribution.—Found on the coast range of mountains, frequently near the sea, as, for example, at Humboldt's Bay. It extends northwards from Monterey along the coast range. It also extends along the eastern slope of the same range, as far north as Shasta. Jeffrey found it in lat. 41, at an elevation of 5000 feet.

History.—First discovered by Dr Coulter, and described by Don from the specimens which that explorer sent home. Dr Coulter found it growing close to the sea-beach, mixed with other pines. Hartweg next found it, in August 1846, in the mountains of Santa Cruz, which lie not far from the sea, some 60 miles north of Monterey. It was then first introduced into this country. Jeffrey found it near Shasta in 1852; Murray and Beardley in 1854; and Lobb, Bridges, and various other collectors, have since helped to introduce it into this country.

Properties

Properties and Uses.—The Californian settlers find the timber serviceable for house purposes ; but our knowledge of it is very limited, and no information has been obtained concerning its durability.

Culture.—A good many plants are now to be found in this country, but none of any great size. A specimen in Mr Gambier Parry's Pinetum, at Highnam Court, Gloucestershire, was seventeen feet high in 1859. It was killed by the severity of the cold in 1860. About a third of the plants of this species reported on by Mr Palmer succumbed to that winter. His tables shew its effects on trees at nineteen places in England, at nine of which trees were killed, at two much injured, at three slightly injured, and at five uninjured. In Scotland, he reports from only three places : at one, plants were killed ; at another, injured ; and at a third they were uninjured. In the only place noted in Ireland, they were not injured. His report on Mid-Lothian mentions that all the plants sent by Jeffrey were quite safe, while those sent home by another collector had all died ; a result, no doubt, to be ascribed to Jeffrey having gathered the seeds which he sent, at the northern limits of the species (Shafta) ; while the others were probably collected from its (more accessible) southern limits, near Monterey.

Commercial Statistics.—Price of seedlings in 1851, 6s. each in pots. In 1852, 6 to 9 inches, 2s. each. In 1865, 12 to 18 inches, 3s. 6d. each ; 18 to 24 inches, 5s.



ARAUCARIA IMBRICATA.

ARAUCARIA IMBRICATA.

CHILI PINE—PEHUEN OR PEGHUEN OF THE CHILIAN INDIANS.

IDENTIFICATION.—ARAUCARIA IMBRICATA, Pavon, in *Mem. Acad. Madr.*, i. p. 197 (1785); Lambert, *Genus Pinus*, ed. 1, ii. p. 9 (1824); ed. 2, ii. p. 106 (1828); Pæppig, *Reise in Chili*, i. p. 400 (1835); Loudon, *Arbor. Brit.*, iv. p. 2432 (1838); Forbes, *Pinet. Woburn.*, p. 163 (1839); Loudon, *Encycl. of Trees*, p. 1062 (1842); Link, in *Linnaea*, xv. p. 542 (1842); C. Gay, in *Historia física de Chili*, Flor., v. p. 415 (1845); Antoine, *Conif.*, p. 107 (1846); Endlicher, *Syn. Conif.*, p. 186 (1847); Lindley and Gordon, *Journ. Hort. Soc.*, v. p. 220 (1850); Knight, *Syn. Conif.*, p. 44 (1850); Carrière, *Traité Gén. des Conif.*, p. 416 (1855); Gordon, *Pinetum*, p. 24 (1858); Henkel and Hochstetter, *Synop. Nadelholzen*, p. 4 (1865).

PINUS ARAUCARIA, Molina, *Chili*, p. 182 (1782).

DOMBEYA CHILENSIS, Lamark, *Dict.*, ii. p. 301 (1786).

DOMBEYA ARAUCARIA, Rauschel, *Nomencl. Bot.*, ed. 3 (1797).

ABIES ARAUCARIA, Poirer, *Suppl.*, v. p. 35 (1805).

COLYMBEA QUADRIFARIA, Salisb., in *Linnaean Trans.*, viii. p. 315 (1807).

ABIES COLUMBARIA, Desfont., *Hort.*, Paris, p. 212 (1809).

ARAUCARIA CHILENSIS, Mirb., in *Mem. Mus.*, xiii. p. 28 (1825); Spach, *Hist. Nat. Vég. Phaner.*, xi. p. 364 (1842).

ARAUCARIA DOMBEYI, Richard, *Conif.*, p. 86 (1826).

ENGRAVINGS—*Cone and Foliage*.—Lambert, *op. cit.*, ed. 1, t. 4; *op. cit.*, ed. 2, t. 56 and 57; Forbes, *Pinet. Woburn.*, t. 55 and 56; Loudon, *Arbor. Brit.*, iv. f. 2286 and 2292; Loudon, *Encycl. of Trees*, f. 1978 and 1986; Antoine, *op. cit.*, t. 48 and 50; Richard, *Conif.*, t. 20 and 21.

Trees.—Lambert, *op. cit.*, ed. 2, 2 t., *sine num.*; Loudon, *Arbor. Brit.*, iv. f. 2293.

Specific Character.—Arbor monœcia excelsa, coma pyramidato-conica, ramis horizontalibus vel pendentibus foliosis, foliis imbricatis patentibus, lanceolatis acutis pungentibus, subtus haud carinatis, viridibus, strobilis magnis depresso-globosis, squamis acumine incurvato, seminibus cuneatis. Habitat in montibus Chilensibus australibus, inter 35-50 lat. austr.

A lofty monœcious tree, varying in height from 40 to 150 feet, 12 feet in girth, and reaching as high as 40 or 50 feet in the male, and 150 feet in the female. Stem straight. Bark of the old trees nearly a



Fig. 1.—End of Branch.

foot in thickness, of two layers, each 5 or 6 inches deep. The outer, like cork, but resinous; the inner, spongy and resinous. Branches verticillated, usually in fives to eights, the lower ones horizontal or drooping, the upper ones more or less erect, the branchlets covered with leaves for many years (fig. 1). Leaves (fig. 2 upper and fig. 3 under side) ovate-lanceolate, growing in spiral whorls, very stiff, rigid, and sharp-pointed; slightly concave above, smooth, shining, and green on both sides, not keeled below; closely covered on both sides with rows of stomates, varying in number according to the size of the leaf, but usually about 100. A cross section of the leaf shews that resin canals and bundles of fibres are distributed at nearly equal distances across the leaf, as shewn magnified in fig. 4. The resin canals



Fig. 2.—Upper Surface of Leaf.



Fig. 3.—Under Surface of Leaf.

vary in number from 10 to 20 or thereby. They are easily distinguished by being surrounded by a circlet of cells. The leaf is surrounded by a well marked hypoderm under the epidermis. Fig. 5 is a more highly

magnified

magnified section, in which the hypoderm, the resin canal, and the bundle of fibres are all shewn. Male catkins (fig. 6) erect, conico-ovate, somewhat teasle-shaped, growing in clusters; pedunculate, terminal,



Fig. 4.—Magnified cross-section of leaf showing hypoderm, resin canals, and bundles of fibres.

in a leaf-like scale. Cones (see plate) solitary at the end of the branches, erect, very large, dark brown, nearly sphaeroidal, somewhat depressed, of from 6 to 8 inches in diameter. When fully ripe they fall very easily to pieces.



Fig. 6.—Male Catkin.

Scales and bracts (figs. 10, 11, and 12) amalgamated with the seeds, somewhat angular, narrowest at the base, more than an inch in length, forming a thick shell surrounding an edible kernel; without wings; the short lobe, which may be mistaken for a wing, corresponding not to the wing, but to the apex of the scale, and the prominent scale-like apophysis being in truth the bract, and not the scale. The seed (fig. 13) is long and wedge-shaped. Fig. 14 shews it split open. In the mature state it is solitary, and, as already said, its shell absorbs, or is conjoined with, the whole of its usual appendages—the wing, the scale, and the bract. But although the seed thus appears single, it is not so theoretically, or always.

Both Molina and Pavon, who first described the species, say that each scale has two ovaries; and Lambert, in his description of the species, gives a figure, furnished to him by Pavon, in which the presence of the two seeds in the young state is distinctly visible (fig. 15). In the specimens

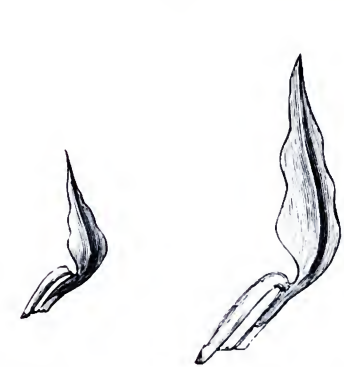


Fig. 8.—Anther—Natural size.

Fig. 9.—Anther Magnified.

which reach this country, the seeds are all solitary; but this is due to their being all mature. We have, through the kindness of Mr Barnes, the gardener at Lady Rolle's, Bicton, had the opportunity of examining the young cones from specimens taken from trees growing at Bicton, and we find that they are exactly as figured by Pavon in Lambert's plate. Almost every part of the tree abounds in a milky-white resin.

According to Pavon, the male tree, in its native country,

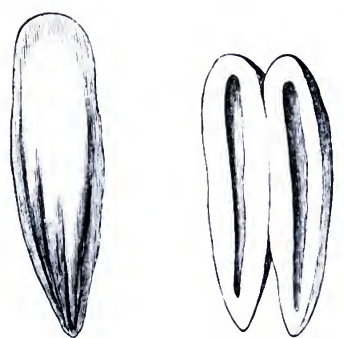


Fig. 13.—Seed.

Fig. 14.—Seed split open.

grows only to 30 or 40 feet high, while the female reaches 150 feet in height. He gives the following account of it in a description published in the *Memoirs of the Royal Academy of Sciences* at Madrid:—"Its trunk is quite straight, and without knots, ending in a pyramid formed of horizontal branches, which decrease in length gradually towards the top, and is covered with a double bark; the inner is 5 or 6 inches thick, fungous, tenacious, porous, and light, from which, as almost from all other parts, flows resin in abundance; the outer is of nearly equal thickness, resembling cork cleft in various directions, and equally resinous with the inner."

yellowish fawn colour, with numerous long recurved stamens. Their position is shewn in the section, fig. 7. Anthers (fig. 8 natural size and fig. 9 slightly magnified), two celled at the base, terminating

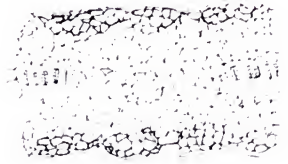


Fig. 5.—More highly magnified cross-section of part of leaf, showing hypoderm, one resin canal, and two bundles of fibres.

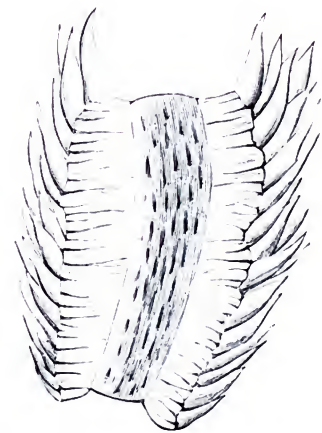


Fig. 7.—Section of Male Catkin.

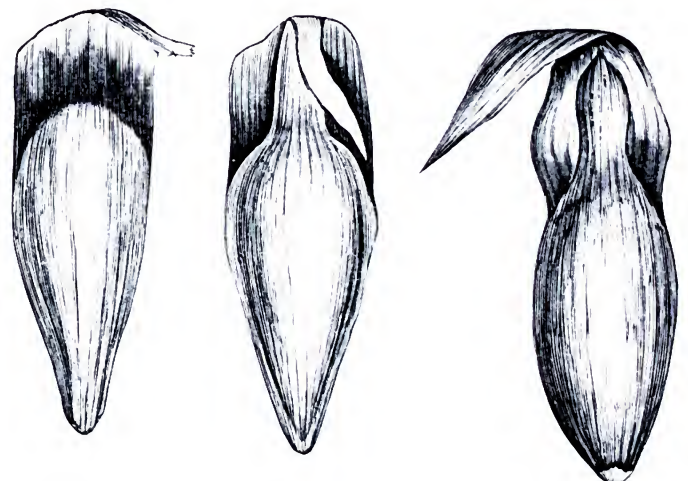


Fig. 10.

Fig. 11.

Fig. 12.

Seeds, Scale, and Bract.



Fig. 15.—Early stage of scale and ovary.



Fig. 4. Four

ARADOCARPA, ARADOCARPA, T. 1888

Printed and Published by W. & A. G. Simpson, Edinburgh

ARAUCARIA IMBRICATA.

3

In the "Travels" here referred to, the following further notice of it occurs:—

"When we arrived at the first *Araucarias*, the sun had just set; still some light remained for their examination. What first struck our attention were the thick roots of these trees, which lie spread over the stony and nearly naked soil, like gigantic serpents, 2 feet or 3 feet in thickness: they are clothed with a rough bark similar to that which invests the lofty pillar-like trunks from 50 feet to 100 feet in height. The crown of foliage occupies only about the upper quarter of the stem, and resembles a large depressed cone. The lower branches, eight or twelve in number, form a circle round the trunk; they diminish till they are but four or six in a ring, and are of most regular formation, all spreading out horizontally, and bending upwards only at their tips. They are thickly invested with leaves that cover them like scales, and are sharp pointed, above an inch broad, and of such hard and woody texture that it requires a sharp knife to sever them from the parent branch. The general aspect of the *Araucaria* is most striking and peculiar, though it undeniably bears a distant family likeness to the Pines of our country. The fruit, placed at the end of the boughs, are of regular globular form, as large as a man's head, and each consists of beautifully imbricated scales that cover the seeds, which are the most important part of this truly noble tree." (See Translation in "Comp. Bot. Mag.," i. p. 367.)

Loudon says that the male tree has its leaves somewhat differently shaped from those of the female tree, and very much resembling those of *A. Brasiliensis* in shape, though of a different texture and colour. So far as we can judge from the growth of the tree in this country, this difference does not appear—at least, in the early state of the tree. Mr Barnes, who has had ample means of forming a judgment from the many fine specimens grown at Bicton, writes thus:—

"There is an erroneous idea prevalent, consequent upon what I conceive to be erroneous descriptions, as to the difference of shape, and habit, and hue of the male and female plant. I am perfectly satisfied that nobody can point out to me, in any way, the difference between the male and female *Araucaria* before they have seen them shew their cones. We have a long avenue of large *Araucarias* here, as many of your readers may know, and many fine specimens in various parts of the grounds. I have seen three females producing cones, and have had fifteen males in full catkin during the early months of the spring season. I cannot understand how it is that travellers state there is such a difference to be seen between males and females in their native country: here I can perceive no trace of a variation of habit, though, perhaps, it may be developed at a maturer age. However, I cannot find a trace of difference, though I have had such a number of trees daily under observation for such a length of time. Besides, it appears unnatural that the female should be higher, producing its cones quite erect on the summit of its branches, as they describe it. The oldest *Araucaria* here is only about 30 feet high, its coning for so many years having prevented it from obtaining a nobler growth, the head being about 26 feet in diameter, with a clean stem of 13 feet to the first branch, and a bole 4 feet in circumference. As it grows on, the lower branches hang down, and eventually get exhausted, while it is growing freely and producing cones as large as a child's head above. This specimen seems falling into the way of the long, straight, and bare-stemmed trees described by travellers." (*Gardeners' Chronicle*, June 1, 1867.)

Mr Barnes further mentions that the catkins are not only produced in spring, but in every month of the year, from the extreme points of the shoots, in bunches of from two to ten, growing in the course of the season to about 4 or 6 inches in length, about the size of a Spruce cone, and so freely produced that, when ripe, the pollen flies about on a fine sunny day in clouds of a yellowish-brown colour.

It has been thought that the tree grows more in the winter time than other trees, for all trees make some growth then, though it may generally be imperceptible. Mr Fowler, forester at Castle Kennedy, found, by a comparison of measurement taken on six plants, in May, November, and February, that the average increase of height, from 3d May to 11th November, was nearly 10 inches, and from 11th November to 22d February 1½ inch (*Scottish Gardener*, v. 117).

The tree does not always make fresh shoots every year, but it often, apparently, stands still for one year, or sometimes two years, and then starts and makes a shoot in the following year. On this point Mr M'Nab, of the Edinburgh Botanic Garden, gives some information derived from the trees cut down after being killed by the frosts of 1860-61 and 1862-63. He says: "For many years past a good deal of speculation has been going on with reference to the tiers of branches as compared with the probable age of the trees. The cutting down of different sized trees in the garden has given us an opportunity of setting this matter, so far, at rest. The largest plant cut down was 24 feet 6 inches high, and 4 feet in circumference at the base. This plant has thirty perfect annual rings, and twenty perfect whorls of branches—proving that eighteen months are necessary to complete one internode and whorl. Two others cut down, both about 16 feet in height, had fifteen perfect tiers of branches, besides an unbranched terminal shoot, and twenty-three annual rings. Many others, averaging 8 feet in height, have eight perfect whorls with unbranched terminal shoots, and about thirteen annual rings. To tell the age of a growing plant of *Araucaria*, count the tiers of branches and add one half the number, making allowance for the unbranched terminal shoot if any; this will give nearly the age of each tree" (*Edin. Phil. Journ.*, 1862, p. 313). Mr M'Nab rightly adds that it is not to be expected that plants ill treated, or growing in very exposed situations or bad

undrained soil, will at all answer the above test. Our experience leads us to think that the instances furnished by the Edinburgh Botanic Garden represent rather too favourable results as to the growth of the tree. We suspect that, on the average, it will be found that the tree takes two years to produce an internode—one to prepare the buds, and the other to push them forward.

Geographical Distribution.—According to Pœppig, who made the most thorough exploration of the range of this species, the *Araucaria* forest of Antuco is the most northerly habitat of this species that is known in Chili; so that the northern boundary may be estimated at 36° south latitude. The extreme southern limit is not so clearly ascertained, which is not surprising, when we consider how little, comparatively, is known of Western Patagonia; it seems probable, however, that it does not stretch far beyond lat. 46° S. Between Antuco and Valdivia this tree only grows upon the Andes, and, as the Indians assert, solely on their declivities, and nowhere lower than from 1500 feet to 2000 feet below the snow line, up to which they frequently reach. Farther to the south, it is found growing at a lower elevation; and in the country of the Cuneos, and about Osorno, is said to occur on mountains of a very moderate altitude, near the sea. The Corcovado, a mountain that rises opposite Chiloe, is said to be studded, from its foot to the snow line, with large groups of these beautiful trees. Of all other vegetation, the *Araucarian* forests are as bare as the Pine woods, offering but few plants to interest the botanist. Steep rocky ridges, where there is no water, are its favourite habitat. (Pœpp. in "Comp. Bot. Mag.," iv. p. 2435-6.)

History.—It is generally believed that the *Araucaria*, or some form of tree closely allied to it, is to be traced in past geological epochs as far back as the coal formations. Trunks of trees, the intimate structure of which, when examined under the microscope, present much the same characters as those of the *Araucaria*, have certainly been found in the coal strata; and so have the remains of other trees in them been determined to be Conifers on the same data; but no undoubted and undisputed specimens of leaves, seeds, or cones, or anything like Conifers, have ever been found in these deposits. It is not until after the New Red Sandstone that the presence of Conifers has been satisfactorily established. It is true that specimens have been described as such, but on examination they have either been proved to belong to something else, or their Coniferous nature has been disputed; and it can, at the utmost, only be stated as matter of individual opinion, dissented from by authorities of as great weight as those who maintain it. That is the case as regards the so-called gymno-spermatous family generally. The *Araucarian* affinity in the coal formation rests on still weaker grounds: it has not even the support of a disputed leaf or cone. It rests entirely on that of the microscopic structure of the wood of the trunks of trees found in the coal measure, and even that imperfect.

An instructive lesson, shewing the necessity of caution in drawing inferences from such characters, may be learned from the *Araucaria* itself, and the very species we have before us. The appearance of the bark at different parts of the same tree, and at different depths, according as its surface is more or less denuded, is so different that each of them, if seen alone, and without knowledge of their connexion with each other, might be taken for portions of wholly different trees. This was first shewn by Professor Balfour, of Edinburgh, from the examination of the bark and timber of the two well-known *Araucarias* which stood in the Edinburgh Botanic Garden, and which were killed by the severity of the winter of 1860-61. ("Proceedings of the Royal Society of Edinburgh," iv. p. 557, 1862.)

These trees had stood for upwards of thirty years, and one of them had attained the height of $24\frac{1}{2}$ feet, with a circumference of 4 feet at the base of the stem, and with twenty whorls of branches. On examining them, the Professor found the timber very hard and heavy, and likely to be valuable timber. In regard to the bark, the scars and markings, and their relation to the leaves, he ascertained that "the appearances presented by the outer and middle bark of *Araucaria imbricata* bore a marked resemblance to those exhibited by certain fossils included in the genera *Sigillaria* and *Lepidodendron*. The sculpturesque markings

ARAUCARIA IMBRICATA.

5

markings on the stems of these fossil plants have induced geologists to look upon them as allied to the Ferns and Lycopods of the present epoch." But it is evident, from Professor Balfour's researches and figures, that caution is required in coming to this conclusion.

The next deposit after the coal measures in which remains occur, which have been referred to the *Araucarias*, is the Magnesian limestone. A specimen from it, first described by Lindley and Hutton, in their "Fossil Flora," under the name of *Voltzia Phillipsii*, has been subsequently referred by Endlicher to *Araucarites*, but the specimen, which is merely that of a few leaves adhering to a branchlet, is much too imperfect to allow of any reliable conclusion being come to either one way or other.

In the lias at Lyme, a specimen of a branchlet with leaves was found, which has been described by Lindley and Hutton, under the name of *Araucaria peregrina*. This seems also a doubtful determination; and the first formation in which fossil remains, whose *Araucarian* character is well established, is the inferior Oolite. A specimen of a cone, which has been named *Araucarites sphaerocarpa*, has been found in a marine limestone of that epoch at Bruton, in Somersetshire, having doubtless been floated out to sea. It is not so nearly allied to the present species as to that section of *Araucarias* which is now confined to Australia and Polynesia.

Leaves of two supposed species (*Araucarites acutifolius* and *Araucarites crassifolius*) have been found in the chalk of Bohemia; and a species (*Araucarites gopperti*), of which both leaves and a cone have been found, occurs in the Lignite of Hæring in the Tyrol. In the more recent deposits, we are not aware of any *Araucarian* fossils having been found.

To come down to historic times, the first knowledge which civilized man had of this species was due to the Spanish Government, of whose operations Mr Clements Markham, in his "Travels in Peru," has given an interesting account. During last century, all the settlements along the Pacific coast of South America belonged to Spain, and hearing from the settlers there of the *Cinchona* bark, and other valuable plants and natural products in the interior, they, with an enlightened liberality which has been so long allowed to slumber, that it sounds strange to our ears, organized a botanical expedition to explore the forests of Peru. It was composed of the botanists Don José Pavon, Don Hippolito Ruiz, Dombey (a Frenchman), and two artists, Brunete and Galvez. They embarked at Cadiz on November 4, 1777, and reached Callao, April 8, 1778. Having made a large collection of plants in the neighbourhood of Lima, and despatched them to Spain, they crossed the Andes, explored the forests of Tarma, and then proceeded to Huanuco. They traversed the valley of Chinchao, explored the hill of Cuchero, or Cocheros, near Huanuco, and discovered seven species of *Cinchona* trees, returning to Lima laden with the precious spoils of their expedition. They then sailed for Chili, and, after exploring the greater part of that province, they returned to Lima, and sent off their botanical collections in fifty-three boxes, which were all lost in the shipwreck of the San Pedro de Alcantara, off the coast of Portugal, in 1780. Mr Dombey returned to Europe at about the same time.

Meantime, in 1780, the Spanish squadron, then lying in the port of Talcaguano, required repairs, but no wood was at hand; and the settlers on the coast, near the Araucarian Indians, having reported the existence of trees on the mountains in the interior, Don Francisco Dendariarena was employed to ascertain if any trees were to be had suitable for shipbuilding, and to examine their fitness. He made the necessary explorations and experiments, and reported the discovery of the *Araucaria*, and that it was probably the best adapted for shipbuilding; and timber of it was accordingly, somehow or other, procured to make the necessary repairs on the squadron.

In 1782 the Government, struck by Dendariarena's report, commissioned Don Pavon to search for the tree, in order to ascertain its range and distribution, and other points, with a view to utilizing it.

Ruiz and Pavon consequently returned to Huanuco, explored the courses of the rivers Pozuza and Huancabamba, and eventually established themselves at the farm of Macora, near Huanuco, where they resided for two months with Don Francisco Pulgar and Don Juan Tafalla, who, by order of the king, had

joined them as pupils and associates in their labours—the first as an artist, the second as a botanist. On these expeditions they met with the *Araucaria imbricata*, which it was part of their mission to look for. In August 1785, a fire broke out in their house, which destroyed all their journals and collections; and they then undertook journeys through the forests of Muna, Pillao, and Chacahursi, examining new species of *Cinchonæ*. On April 1, 1788, taking leave of their companions Pulgar and Tafalla, they sailed from Callao, and reached Cadiz in September, when they commenced the publication of their great work the “Flora Peruviana” (Markham, “Travels in Peru and India,” p. 32). Don Pavon, in his account of the *Araucaria imbricata*, says:—

“In the month of September 1782, I left, for some time, my companion Don Hippolito Ruiz, and visited the mountains named Caramavida and Naguelbuta, belonging to the Llanista, Peguen, and Araucano Indians. I spared neither pains nor expense in fulfilling the objects of my mission, and amongst many plants which were the result of my two months’ excursion, I found in flower and fruit the tree which I was about to describe.

“The chain or Cordillera of the Andes offers to the view, in general, a rocky soil, and in parts wet and boggy, on account of the abundance of rain and snow which fall in these regions, similar to many provinces of Spain. There are to be seen large forests of this tree, which rises to the height of 150 feet.”

In 1795, Captain Vancouver touched on the coast of Chili; and Mr Menzies, who accompanied the expedition, procured cones, and sowed some of their seeds on board the ship, and brought home living plants, which he presented to Sir Joseph Banks, who planted one of them in his own garden at Spring Grove, and sent the others to Kew, where one (the oldest, though far from the largest) still survives. From this circumstance the tree was called at first in England “Sir Joseph Banks Pine.”

The next author who added to our stock of original information on the subject was Pœppig, afterwards Professor of Botany in Leipzig. He was sent out to explore and collect plants in South America by a German Botanical Society, and the following brief summary of his labours, contained in a letter to the late Sir W. Hooker (see Hooker’s “Journal of Botany,” i. p. 380), will give the reader a general idea of him and his work. Dr Pœppig says:—

“I crossed South America, from Peru to Para, on the Amazon, but I had so hard a stand that I could not advise another to follow that track. Be it understood that I was inured by long custom and seasoned to every hardship, that I spoke rather fluently the language of the Incas—and yet I almost abandoned the task! Amidst savages and millions of mosquitos—widely separated from any civilized being—quite solitary—the only European in an immense province—without shoes and without clothes—often without a monkey to dine upon—unkindly treated by petty authorities, though protected by the far distant government of Lima—once even a kind of prisoner for the space of three months—under all these privations, thank God, I did not flag; but, my resolution rising in proportion as my difficulties increased, I even lived in the thickest wilderness of Maynas nearly eighteen months, working day and night, though friendless and quite limited to my own personal resources, whether as regarded my body or mind. The whole cost for five years to the Society which sent me out only amounted to 4500 German dollars, which have been refunded to them by collections on which they have themselves fixed the value, so that not a groat remains unpaid; and they had besides a profit of 10 per cent. allowed; nevertheless, an immense botanical collection remained to me (5500 species, exclusive of the lower cryptogamic orders), and so many well prepared animals, that I have been enabled to make liberal presents to our public collections. The Society received 1750 species of plants, ten samples of each = 17,500, besides many hundred birds and quadrupeds. A great number of Chilian plants have been diffused upon the Continent that were originally reared from my seeds, as *Francoa*, which may be seen growing in the gardens and churchyards of our most secluded villages, *Tetilla*, *Nassauvia*, *Paya*, and several species of *Escallonia*. The only specimens of *Araucaria chilensis* (*imbricata*) which exist on the Continent (I think you do not possess that king of trees?) are now here (Leipzig), raised from seeds which I gathered in the wild country of the Pichuenches among a thousand dangers. Six of these have survived the perils of their early growth, and are nearly 2 feet high, while forty or more have successively died. Journals, with descriptions made on the spot, of 2300 species of plants; others on zoology, partly printed in *Froriep* (*i.e.*, *Frorieps Notizen aus d. Geb., d. Natur. und Heilk.*); others containing remarks and researches of a more genial kind; 200 sheets of drawings, among which are all the Chilian *Orchidæ* and the most splendid Peruvian forms; also the materials for a monograph of the tropical American *Aroidæ* (these of colossal dimensions), have safely reached Europe, and surround me at the present moment. The “Travels” are printing; the first number of my “*Novæ Species Plantarum*,” edited in company with Endlicher of Vienna, will also soon be out, and I send a fragment of it along with the plants. Thus you see how much a man may work, provided he has nothing else to do but to work.”

The scientific history of the species need not detain us long. Its first describer was the Abbè Molina, who was writing his “Civil and Natural History of Chili” (published in 1782) at the time that Dendariarena was making his experiments; and he described it under the name *Pinus Araucaria*, shewing a keener appreciation of its affinities than we should perhaps have looked for at that date. Next, Don Pavon, treating it more critically, recognized it as belonging to a new species of Conifer, which he called *Araucaria*, and gave the species the name which it still bears. He had, previously to his publication, however, sent specimens to France to the care of Dombey, his former fellow traveller, and that gentleman shewed it to two of the chief botanists in Paris at the time—Jussieu and Lamarck. Jussieu made no alteration on

Pavon’s

ARAUCARIA IMBRICATA.

7

Pavon's name; but Lamareck, most probably in ignorance of it, published it in the "Encyclopædia Methodique," under the name of *Dombeya Chilensis*. It seems scant justice to honour the name of the intermediary at home, to whom the new species was sent, in preference to that of the explorer who sent it; but we are bound to acknowledge that it is an injustice which has often been perpetrated with less apology than in the present instance, where Dombey had been at least personally a partner in Pavon's toils and dangers, and may possibly have seen the tree in its wild state with him.

Several other names were given to it by various authors shortly after the first descriptions, before the claims of priority were definitely recognised. These names will be seen in our synonymy at the commencement. It is, however, long since Pavon's name has been universally recognised. In England, Lambert merely repeated Pavon's description in his "Genus Pinus," with the addition of one or two minor details, which were communicated to him by Pavon, who had omitted them in his own description. Since then no material addition has been made to our knowledge of the plant, although our appreciation of the true relations of the different parts of the fruit is probably truer.

Properties and Uses.—Pavon's account of the properties of this tree is that the wood is yellowish-white, fibrous, full of very beautiful veins, and capable of being polished and worked with facility. The timber is admirably adapted for ship-building. The resin, which abounds in all parts of the tree, is white, its smell like that of frankincense, and its taste not unpleasant. It is applied in plaster as a remedy for contusions and putrid ulcers, it is supposed to cicatrize recent wounds, to strengthen fractures and relaxations, and to mitigate headaches, and it is used as a diuretic (in pills), and to cleanse venereal ulcers. The Indians eat the fruit raw, as well as boiled and roasted; with it they make pastry, and distil from it a spirituous liquor. There are stated times for collecting the fruit, which they preserve to make use of when required.

On the same head, Dr Pœppig says:—

"The *Araucaria* is the Palm of those Indians who inhabit the Chilian Andes from lat. 37° to 48°, yielding to these nomad nations a vegetable substance that is found in the greater plenty the more they recede from the whites, and the more difficult they find it to obtain by commerce. Such is the extent of the *Araucaria* forests (*Pinones*), and the amazing quantity of nutritious seed that each full-grown tree produces, that the Indians are ever secure from want, and even the discord that prevails frequently among the different hordes does not prevent the quiet collection of this kind of harvest. A single fruit (*cabeza*, a head) contains between 200 and 300 kernels, and there are frequently twenty or thirty fruits on one stem; and as even a hearty eater among the Indians, except he should be wholly deprived of every other kind of sustenance, cannot consume more than 200 nuts in a day, it is obvious that eighteen *Araucaria* trees will maintain a single person for a whole year. The kernel, which is of the shape of an Almond, but double the size, is surrounded with a coriaceous membrane that is easily removed; though relishing when prepared, it is not easily digestible, and, containing but a small quantity of oil, is apt to cause disorders of the stomach to those who are not accustomed to this diet. When the scarcely-matured seeds are dried in the sun, a sugary substance exudes, which appears to reside chiefly in the embryo. The Indians eat them either fresh, boiled, or roasted; and the latter mode of cooking gives them a flavour something like that of a Chestnut. For winter use they are dried after being boiled, and the women prepare a kind of flour and pastry from them. . . . If a branch be scratched or the scales of unripe fruit be broken, a thick milky juice immediately exudes that soon changes to a yellowish resin, of which the smell is agreeable, and which is considered by the Chilians to possess medicinal virtues, and to be able to cure the most violent rheumatic headaches when applied to the spot where the pain is felt." (Translated from "Pœppig's Journey," in *Comp. to Bot. Mag.*, i. p. 355.)

Mrs Maria Graham, afterwards Lady Calcott, in her "Journal of a Residence in Chili in 1822-1824," p. 508, speaks of its uses in very much the same terms.

It is rather remarkable that, notwithstanding the high commendation of the timber for ship-building by the Spanish Commissioners, little or no use seems to have been subsequently made of it for this purpose. Pœppig probably indicates the cause of this when he says that the timber yields to none in hardness and solidity, and might prove valuable for many uses, if *the places of growth of the tree were less inaccessible*. "For ship-building," says he, "it would be useful, *but it is much too heavy for masts*." It is unquestionably very hard, very solid, and very heavy. It would, doubtless, make beautiful furniture. Being very close in the grain, it takes an exceedingly fine polish, while the colour is fine, the heart wood being bright yellow, and the young wood white, unless when the tree has been exposed to forest fires, when the wood becomes red.

PINETUM BRITANNICUM.

Culture.—Mr Palmer’s reports on the worst effects of the winter of 1860-61 on this tree, give the following results :—

	Killed.	Much injured.	Injured.	Not injured.	Total.
England	32	11	14	29	86
Scotland	23	8	23	17	71
Ireland	—	1	—	4	5
	55	20	37	50	162

An analysis of the situation of the places which suffered most gives no very definite data for generalization. No doubt the most southern counties, Cornwall, Somerset, Devon, &c., escaped without injury ; but mere increase of latitude is not at all uniformly accompanied with increase of mortality, the tree having escaped unhurt in many of the northern counties, while it suffered severely in others more to the south. The situation of individual localities probably had much to do with the amount of mischief. Many fine trees, which had lived unhurt for twenty-five years, fell victims to the severity of that winter ; and many which had lived through it, gave way in the winter of 1862-63, their constitution having not, perhaps, fully recovered from the previous attacks of that of 1860-61. In fact, probably, more perished in 1862-63 than in 1860-61. Nevertheless, many finer than any that have gone still survive, as will be seen from the following list of the heights and ages of some of the most remarkable trees in England, taken subsequent to 1860 :—

County.	Place.	Height.	Age.	Date of Measure-ment.	County.	Place.	Height.	Age.	Date of Measure-ment.
Bucks	Dropmore	50	73	1867	Devon	Grantlands	25	—	1867
"	"	47	37	"	Wigtownshire	Castle Kennedy	25	20	"
"	"	41	37	"	Cork	Castle Martyr	25	20	"
Sussex	Beaufort	41½	—	"	Forfar	Camperdown	24	20	1862
"	"	39	—	"	Staffordshire	Biddulph Grange	24	14	1867
"	"	38½	—	"	Yorkshire	Mulgrave Castle	23	30	1863
"	"	34	—	"	"	"	22	30	"
"	"	30	—	"	Bedfordshire	Woburn Abbey	23	24	1862
"	"	30	—	"	Antrim	Birch Hill	23	21	"
"	"	29	—	"	Sutherland	Dunrobin Castle	23	25	1863
Kilkenny	Woodstock Park	39	30	1863	Perthshire	Taymouth	22	19	1862
Lancashire	Holkar	36	20	1862	"	Dupplin Castle	22	30	1863
Devonshire	Eggesford	35	20	"	"	Murthly Castle	22	—	1862
Rutland	Belvoir Castle	34	30	"	Devonshire	Upcott	22	15	1867
Surrey	Ockham Park	33	—	1867	Fife	Donibristle	22	26	1862
Kirkcudbright	Cairnsmore	32	28	1862	Tyrone	Caledon Hill	21	24	"
Northumberland	Belsay Castle	32	40	1867	Waterford	Lismore Castle	21	20	"
"	"	31	—	"	Cardigan	Hafod	20	18	"
Lancashire	Calderstone	31	30	1862	Montgomery	Powis Castle	20	26	1864
Surrey	Wimbledon	30	35	"	Denbighshire	Coed Coch	20	22	1862
"	Kew	31	70	1867	Westmoreland	Ambleside	20	21	1867
Devonshire	Bicton	30	30	"	Cornwall	Bownnoe	20	20	1862
Montrose	Craig	30	—	"	Devonshire	Watcombe	20	12	"
Gloucestershire	Tortworth Court	28	26	1862	Lancashire	Cuerden Hall	20	16	1864
Herefordshire	Hatfield House	27	22	"	Cornwall	Curelew	20	20	1862
Derbyshire	Elvaston	26	27	"	Devonshire	Woodovis	20	20	"
Herefordshire	Bayfordbury	26	27	1867	Middlesex	Enfield Chase	20	20	"
Gloucestershire	Highnam Court	26	24	1863	Norfolk	Holkham	20	18	"
Perthshire	Keir	26	27	1862	Shropshire	Halston Hall	20	24	"
Kent	Redleaf	25	20	"	Cheshire	Norcliffe	20	24	"
Suffolk	Easton Park	25	20	"	Berkshire	Windsor	17	15	"
Herts	Aldenham Abbey	25	24	1867	Isle of Wight	Osborne	16	25	"
Peebles	Dalwick	25	20	1862	Denbighshire	Hafodunos	15	26	"

The finest of these trees are the well-known specimens at Dropmore, of the largest of which we give a portrait. It is a male, and is now upwards of 60 feet in height. In June 1867, it was 50 feet. Its stem was

ARAUCARIA IMBRICATA.

9

was then 6 feet 7 inches in girth near the ground; and, at 3 feet from the ground, 5 feet 6 inches in girth. The diameter of the spread of its branches was 26 feet 4 inches. For several years previous it had been covered with magnificent catkins. It grew 5 feet in four years, it having been 45 feet in height in 1863. Its subsequent growth has been at the rate of about 6 inches each year. There are other fine *Araucarias* at Dropmore, but none equal to the one in question. Its supremacy is probably due to the conditions in which it is situated, viz., growing on a mound of soil placed in the site of an old gravel pit, filled up and raised many feet. Mr Frost, the gardener at Dropmore, says that probably it has 15 feet or 20 feet depth of soil on which to grow.

Two of the other trees at Dropmore are not far behind this specimen. They are about fifty years of age, having been planted out forty-six years ago. The one is 2 feet shorter than that of which we have spoken, and the other 8 or 9 feet shorter. They are growing in prepared soil 3 feet deep and 30 feet in diameter.

The tree at Kew, already mentioned as having been one of those brought home by Menzies in the end of last century, and presented first to Sir Joseph Banks, and by him sent to Kew, was at first kept in a greenhouse until about 1806 or 1808, when it was planted out by the elder M'Nab, afterwards superintendent of the Edinburgh Botanic Garden. After it was planted out, it appears that, not being considered quite hardy, it was protected during winter with a temporary frame covered with mats; and when Loudon wrote (1836), this practice was still continued, it being thought unsafe to leave it off. At that date it had only reached 12 feet in height. It had a stunted, unhealthy appearance—all the lower branches being gone—a sure sign that something was seriously wrong in the soil, position, or conditions of life of the tree. This injudicious treatment it has never recovered. Although twice the age of any other *A. imbricata* in Great Britain, it is now little more than 30 feet high, and it was all but killed in the severe winter of 1866-67.

The finest tree in Scotland is that at Cairnsmore, in Kirkcudbright. The plant was sent from the Edinburgh Botanic Garden in 1835, but was not planted out until 1837, when it was about 2 feet in height. Its height in 1856 was 25 feet, the diameter of the spread of branches 16 feet, the girth of the bole, 3 feet from the ground, 2 feet 8 inches. It was then in a very healthy state, a perfect picture, clothed to the ground; and the lower branches being pendulous, added very much to its elegant appearance. In 1862, it was 32 feet in height. Those which were the pride of the Edinburgh Royal Botanic Garden came very near this tree in beauty and size.

It will be observed from the foregoing list of heights of trees, that Devonshire and Cornwall do not, in the present instance, maintain their wonted superiority on that point; and the rate of growth at Osborne contrasts unfavourably with that in the inland counties. At Castle Kennedy, however, which is only a mile or two from the sea, it thrives luxuriantly. It stands ordinary cold very well, and in its native country is exposed to as much as it meets with here, unless on exceptional occasions, which may, perhaps, not occur twice in a century. Notwithstanding its endurance of cold in Chili, it is plain that it may have too much of it here, and we must act accordingly.

It is somewhat particular in regard to soil. The most general experience is that it must have a good and rather open soil, although the kind of soil is of less consequence. It does not like a retentive soil, but it will thrive even in moss if well drained, and if it be in that state that it can extract nourishment from the decayed vegetable matter. If in a moist climate, with a well-drained soil, it seems not to require so rich a soil. Mr Begbie, the gardener at Castle Martyr, near Cork, reports that "it luxuriates in our poor soil on our porous red sandstone, and is even to be found growing vigorously in heaps of stones with only a surface covering of weeds." But this is exceptional; our own experience, and that of most others whom we have heard speak on the subject, is, that whatever the soil be, it must have an ample supply of nourishment. Instances in proof of this must recur to every one who has grown the tree. We have seen young plants, which have stood for years without growing an inch higher, and which were the despair of their owner, suddenly start away and grow vigorously on being removed into better soil, or supplied with more nourishment. We remember, many years ago, and while the prejudice against giving

manure to Conifers still subsisted, being present when the late Mr Charles M'Intosh was consulted by a proprietor who had a few *Araucarias* all standing at the same level at which they had been received from the nursery some years before—that is, about a foot high. He recommended their removal into better soil, or a supply of manure to be applied to their roots. Both plans were tried, and both were successful. The plants soon started, and are now of some size. Mr Barnes, in the *Gardeners' Chronicle* (1st June 1867), gives an instructive account of his experiences to the same effect. The two trees which formed the subjects of Mr Barnes' experiments, are male and female, and have produced abundance of flower and fruit, from which a promising young progeny has been reared. These, however, are by no means the only instances of the tree flowering and fruiting in Britain. The tree at Kew has repeatedly flowered and fruited, so has that at Dropmore; the fruiting of those at Bickton we have already spoken of. A tree at Tortworth Court was covered with magnificent cones in 1864; and, doubtless, at many other places they were similarly fruitful. The first tree, however, which flowered in Europe is understood to have been one in the garden of the Marquis Ridolphi, near Turin, which flowered in September 1840.

In choosing a locality in which to plant the *Araucaria*, there is no need to select warm sheltered situations. It prefers open and exposed spots, where it braves the storm and defies the breeze, at the same time receiving a fairer share of sunshine; but it should not be exposed to a very low temperature. These are the localities which it affects in its native countries, and it is only reasonable to expect that they should suit it here. Mr Fowler, the gardener at Castle Kennedy, mentions that this had been tried at that place by Lord Dalrymple, a considerable number having, some seven or eight years previous to the time he wrote (1860), been planted in a very exposed situation, where they were growing with remarkable luxuriance, already doubling the size of Scotch Firs and other trees, which had been planted as nurses several years before them. On inquiring of Mr Fowler what had been their progress since, he wrote us (July 1867) that "the trees are still thriving—indeed, pictures of perfect health, as all our *Araucarias* are—they not having suffered on any occasion from the severity of the winter. This arises, no doubt," says he, "from our geographical position, and consequent high winter temperature, the thermometer seldom indicating more than 16° of frost. I observe no tree in this locality, where we suffer much from high winds, so well adapted to plant in exposed situations as the *Araucaria imbricata*, as it suffers no further than a little bruising of the foliage, occasioned by the branches coming in violent contact with each other during gales of wind. We had some trying weather last April in the shape of cold frosty east winds, which continued for nearly a fortnight. The effect is still visible on most of our Coniferæ. Even the *Pinus Austriaca* and the common Scotch Fir, on the exposed side, had much of their last year's growths killed. The *Araucarias* were not, in a single instance, injured, except as indicated above. I have a strong impression that the *Araucaria* will yet clothe many a hillside where almost nothing else will live—particularly in situations not too far removed from the seaside. At present there is considerable prejudice against its cultivation, arising from the destruction of so many specimens during the severe winter of 1862-63. The great success which has attended the planting of it out in suitable soils and situations, will help to remove this; and when more knowledge becomes diffused among planters of the climate, soil, and situation most suitable for its successful culture, I venture to predict that a tree so unique and so beautiful will yet be extensively planted in these islands; and that it will thrive in a much greater variety of situations than is generally supposed, always avoiding to plant it in situations where the thermometer ranges very low. Here they are grown by the hundred, many of the best specimens being upwards of 25 feet in height, none of which were planted before 1847."

Another, and a not less important point to be attended to in choosing a site for planting *Araucarias*, is to see that the soil is thoroughly drained. We have already said that it likes an open porous soil, but it equally dislikes a close retentive soil; but this is only saying, in other words, that it requires good drainage. A retentive soil is more difficult to drain effectually than an open soil, and is, in fact, generally badly drained; and this is, doubtless, the reason why it prefers the one soil to the other. It is not, however,

that

ARAUCARIA IMBRICATA.

11

that it has any disinclination to moisture. Like the majority of Conifers, it likes water, notwithstanding Pöppig's statement, already quoted, that in Chili its favourite habitat is steep rocky ridges where there is no water. That statement must not be taken too literally. The testimony of other travellers (such as that of Pavon above quoted) shews merely what we see at home, that it is not fresh water, or plenty of it, that it dislikes, but stagnant water, which disagrees with it. It cannot endure water standing about its roots. A wet subsoil is destruction to it as soon as its roots reach it; but, properly applied, it delights in moisture.

We may give, as an illustration of moisture properly applied, the instance of the two trees which stood in the Royal Botanic Garden, Edinburgh, of which we have already spoken. These are reported to have owed much of their unusual size and vigour to an intelligent appreciation of their natural conditions in their native country, and a practical imitation of it in this, by Mr M'Nab, who has charge of the Botanic Garden in Edinburgh. He reasoned thus: "The *Araucaria* grows in a country whose climate is subject to excessive moisture at the period of the year when the winter's snows on the peaks above begin to melt at the approach of summer. So far as moisture is concerned, therefore, the treatment indicated would appear to be a liberal supply of water in spring to imitate the melting of the snows." On this hint Mr M'Nab acted. "During the last fifteen years," says he (*Edin. Phil. Trans.*, 1862, p. 313), "the two large plants were regularly supplied every morning with thirty barrels of water, besides a triennial renewal of the soil round the extremities of the roots, composed of very old rotted manure and loam. This may account for the very large size of the annual layers produced during the last fifteen years, compared with those sections where no extra water was given."

The success, in this instance, may also have been to some extent due to the trees being planted in good deep soil. We have already pointed out the advantage of this. Where the tree is growing in poor soil, top-dressing and stirring the surface above the roots will be found of great benefit. There used to be a strong prejudice against applying anything in the shape of manure to Coniferous trees, and it is not wholly abandoned even yet. Against its injudicious or excessive application we retain the prejudice; but properly applied, it is not easy to exceed with the *Araucaria*.

Mr Fowler (*loc. cit.*, p. 158) narrates an instance of its application at Castle Kennedy, which, from its comparative character, would be conclusive on the point, if confirmation were needed:—

"I had an opportunity, some years ago, of seeing this illustrated on rather a large scale. An avenue had to be made level across, running east and west, on a piece of ground hanging considerably to the north, which involved 3 or 4 feet of cutting on the south side, and the same amount of banking on the north side; the surface soil on the south side was taken off, to the depth of 18 inches or 2 feet, and retained. The trees in due course were planted. For a few years afterwards they made nearly equal progress on both sides, till the roots of those on the south side reached the subsoil (an impenetrable gravel); those on the opposite side, having depth of open porous soil, shot rapidly ahead—a state of matters which was very objectionable, and to remedy which it was necessary to commence top-dressing. This had to be cautiously gone about, as a prejudice did then, and still exists to some extent, against applying anything like manures to Coniferous plants. I commenced by using what is known as vegetable waste as a top-dressing—the refuse of the garden after being well rotted. The beneficial effect was soon apparent. In a few weeks the colour of the foliage became much darker, and in the following season the growth of the trees treated in this manner was much greater, and for years afterwards the effect was apparent. I have since very frequently applied liberal top-dressings of any rich compost I can get hold of, including rotten leaves, old hot-bed dung, &c., to any Conifers which assume that dry unhealthy appearance which many of them do when planted on poor thin soils. The result is very satisfactory with all, but with none more so than with the *A. imbricata*. I generally apply the top-dressings either in winter or spring, but any other season might answer."

Mr Fowler also speaks of the advantage of stirring the soil and keeping it clear of weeds—a practice now very generally adopted for all trees which are much cherished or require care:—

"The *Araucaria* thrives much better when the soil is occasionally stirred and kept clear of weeds. An avenue was planted here in 1847. The one side has always since been dug, hoed, and kept clean. The other is and has been under grass since planted. The growth of the trees averages somewhere in the proportion of 9½ on the grass to 12 on the red land. Previous to planting, the soil on both sides had been trenched to the depth of nearly 2 feet. If any difference in quality exists, it is in favour of the side under grass."

The *Araucaria*, generally speaking, does not suffer from vermin, although sometimes rabbits attack it. Sheep, however, seem to be fond of it. Some years since we happened to visit the late Mr Blandy, of High Grove, Reading, the morning after a flock of sheep had been imprudently turned into a small field of his in which were a row of young unprotected *Araucarias*: next morning every *Araucaria* was standing

under bare poles. Every leaf within reach had been nibbled off, and the stem barked to the bone, leaving it white, partly from resin exuding from the wounds, and partly from the exposed white wood.

At first sight one would not suppose the *Araucaria* a very good subject on which to practise with the knife, but it stands pruning better than most Conifers. Mr Blandy informed us that he had observed, that if the branches which have to be removed are cut off at a short distance from the stem, fresh shoots spring from the base of the branches, whereas this is not the case if the branches are cut off quite flush with the stem. This supplies us with a means of replacing such branches as have become unsightly and attenuated by accident or otherwise. Mr M'Nab alludes to it as a means of more rapidly replacing large trees which, after injury from frost or otherwise, may have been cut down to save their lives, like the masts of a shipwrecked vessel. "The *Araucaria*, when cut down, very generally gives out shoots from the stool." Mr M'Nab says "that the lower the trees are cut, the fewer and stronger will be the shoots produced—these can be finally thinned out to single stems." Mr Fowler also bears testimony to the impunity with which it may be pruned. "I have frequently had occasion," says he, "to prune it; and wherever cut, dormant buds are ready, at the axil of every leaf, to start into active existence; in short, it stands the knife as well as either the Holly or the Yew, and, in suitable soils, either for ornament or impenetrability, would be superior to either." This property, he suggests, might be taken advantage of by using the *Araucaria* as a hedge-row plant, if the price of plants were once sufficiently moderate. The many trees now fruiting promise that, ere long, plants will be abundant, and we may then have hedges which, with not less beauty than the Holly or the Yew, will be more rapid in their growth, and infinitely more impenetrable. As, however, it appears that they would be useless against sheep, it is possible that they might not be less palatable or more formidable to cattle; but against human intruders, as fences around lawns and about a house, we imagine they would be impregnable.

There is nothing peculiar in the growth of the seeds, or in the management and rearing of the young plants. The seeds may be planted in various ways, but the usual and most natural plan is to prick them into the ground for two-thirds of their length, the narrow end downwards. A little bottom heat brings them briskly away, and their large size enables every step in the development of the young seedlings to be easily studied. As in other plants, considerable variety occurs in the idiosyncrasy, habit, and constitution of different individuals. Some have their branches curved and growing upright, resembling antient candelabra, others throwing out their branches horizontally, and others are partially pendulous. Variegated individuals have also been raised.

Commercial Statistics and Prices.—In 1838, the prices of plants, 9 to 15 inches high, varied from 2 to 5 guineas each. In 1840, one-year seedlings were first offered in considerable quantities at £5 to £6 per 100; and five years later, those of the same plants that were 6 to 9 inches high were £10 per 100, or £1, 10s. per dozen, and extra fine plants £3 per dozen. In 1850, 6- to 9-inch plants were 24s. per dozen; 12 to 15 inches, 3s. 6d. each; and 18 to 24 inches, 7s. 6d. In 1856, one-year-old seedlings were 7s. 6d., and two-year old 10s. 6d. per dozen; 1 foot high plants, 2s. each; 18 inches, 3s. 6d.; 2 feet, 7s. 6d. to 10s. 6d.; 2½ feet, 25s. to 30s.; 3½ to 4½ feet, 35s. to 50s.; 5 to 6 feet, 63s. to 105s.; and from the last-named date till the present time (1876), a usual practice has been to charge a guinea per foot in height for plants above 6 feet that are of fine symmetrical form, and that have been previously frequently transplanted. In the most recently published nursery catalogues, reductions of from 10 to 20 per cent. are made from the last quoted prices, except for one and two-year-old seedlings, which, being at present very scarce, are entirely omitted in most of them.

Seeds.—These have hitherto been procurable only in irregular quantities and qualities; and as many in even the best cargoes are incapable of vegetating, the prices have varied from 30s. to 75s. per 1000.

